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THE SOCIAL SCIENCES AND HISTORY

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A RECONNAISSANCE GEOGRAPHY OF JAPAN

BY

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OF GEOGRAPHY

UNIVERSITY OF WISCONSIN

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Field work in Japan during 1926-1927 was made possible by a generous subsidy from the John Simon Guggenheim Memorial Foundation. A Grant-in-Aid from the National Research Council and additional subvention from the University of Wisconsin Research Fund permitted further field work during the summer of 1932.

ERRATA

UNIVERSITY OF WISCONSIN STUDIES, No. 22
A RECONNAISANCE GEOGRAPHY OF JAPAN
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Glenn Thomas Trewartha

1. p. 85, line 16. Substitute "sixth" for "quarter"
2. p. 106, line 17. Substitute "Nemuro" for "Kushiro".
3. p. 201. Interchange headings "imports" and "exports" in the table showing Composition of the Foreign Trade of Kobe, 1929.
4. p. 213, third line from bottom. Substitute "Onomichi" for "Omomichi".
5. p.223, line 29. Substitute "Seburu" for "Seburn"

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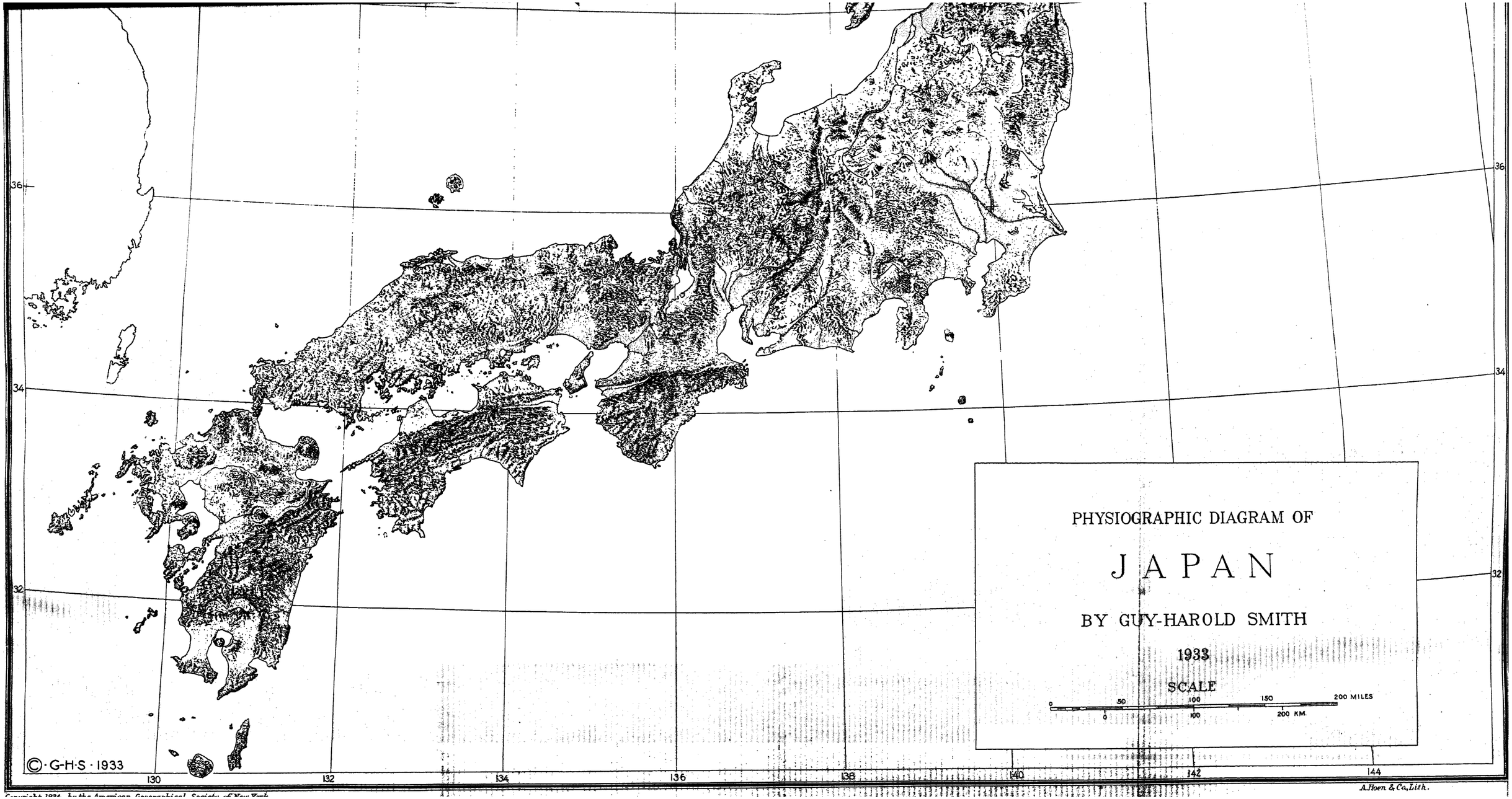
INTRODUCTION

Macro rather than micro-analysis characterizes the content of this study. Japan Proper with which it is concerned is only a single unit or subdivision of the larger Monsoon Realm of eastern and southern Asia, one of the world's great geographic divisions. Any geographic study of Nippon must of necessity therefore contribute to a better understanding of the larger Monsoon Realm of which it, Japan, is an integral part. It is in Part I of the present monograph, which treats of Japan Proper as a unit, that this concept is brought to the forefront. In that section those landscape characteristics belonging to the archipelago as a whole have been particularly emphasized, while intraregional contrasts have received little attention. The amount of space devoted to each of the subdivisions of Part I is no indication of their relative importance. For example, since very excellent and detailed studies of Japan's minerals, manufacturing and trade are at present readily available, only brief summaries of these forms of production are here included. On the other hand population and settlements are more adequately treated.

Not only is Japan one unit of the larger Monsoon Realm, but it likewise is composed of a mosaic of smaller spaces differing in their surface expressions, and it is with these areal differentiations, based primarily upon reconnaissance methods of observation, that Part II, the body of the monograph, is concerned. Unless preceded by a survey in gross morphology, detailed studies of limited areas are likely to be less useful than they should be because they are isolated fragments not clearly related to a larger whole of which they are a part. Part II of the present monograph provides such a study in gross analysis for Japan, planned to be intrinsically useful for its own content, but likewise designed to provide a geographic framework for Nippon, into which past and future studies of limited areas will fit and have a place.

To such reconnaissance treatment, either in field observation or written description, Nippon offers certain peculiar difficulties because it is composed of numerous small isolated units



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PART I

THE COUNTRY AS A WHOLE: LINEAMENTS OF FUNDAMENT AND CULTURE

A. THE NATURAL FEATURES

1. Surface Configuration and Drainage

Along the Pacific coast of Asia is a festoon of mountainous islands arranged from north to south in the form of three great arcs, all convex toward the ocean. The main and central of these mountain arcs is Japan Proper (147,416 sq. mi.[1]), consisting of four principal islands, Hokkaido, Honshu, Shikoku and Kyushu, separated from each other by seas occupying tectonic depressions. At its northern (Hokkaido) and southern (Kyushu) extremities the Japan Arc is intersected by the Kurile and Ryukyu Arcs respectively, resulting in zones of weakness, into which have been ejected great volcanic piles.

The Japanese Archipelago is the crests of partially submerged mountain ranges, complex in composition and structure. By some geologists they are described as essentially Alpine in type; others contend that they represent the summits of one of the outermost series of crescentic tilted blocks forming the Pacific margins of Asia from which continent they are separated by the depressions of the intervening seas. On the east, not far off shore, tremendous downthrow of the rock strata has resulted in one of the greatest deeps (7,000-9,000 meters) known in any ocean. Like other segments of the circum-Pacific belt of new mountains, with its associated crustal instability and current deformation, Japan is a region of earthquakes and volcanoes.

Complexity and fineness of pattern are the keynote of the geology and geomorphology of Nippon; consequently broad generalization is difficult. Even within small areas there is often the greatest diversity in earth materials, their structures and the landforms resulting. Lofty folded ranges forming the axis of the archipelago have been altered by block movements so that faulted and folded forms are much intermingled. Peneplain remnants at relatively high altitudes are widespread throughout

[1] This figure includes the Kurile and Ryukyu islands which together comprise roughly 5 per cent of the area. They are not however, included in the present study. The Japanese Empire (260,186 sq. mi.) includes, in addition to Japan Proper, southern Sakhalin (Karafuto), Korea (Chosen), Formosa, the leased territory of Kwantung, and numerous small islands in the South Pacific.

the country, contrasting curiously with the steep slopes and high relief. Repeated volcanic eruptions and intrusions, extensive and widespread, have added further complications. Moreover, none of these tectonic forces are at present quiescent; on the contrary their current activity is conspicuously evident in the recurring showers of volcanic ash, outpourings of lava, numerous earthquakes and changing strand lines. Short, steep-gradient streams, acting upon these complex structures and materials, have sculptured a land surface whose lineaments are varied and intricate.

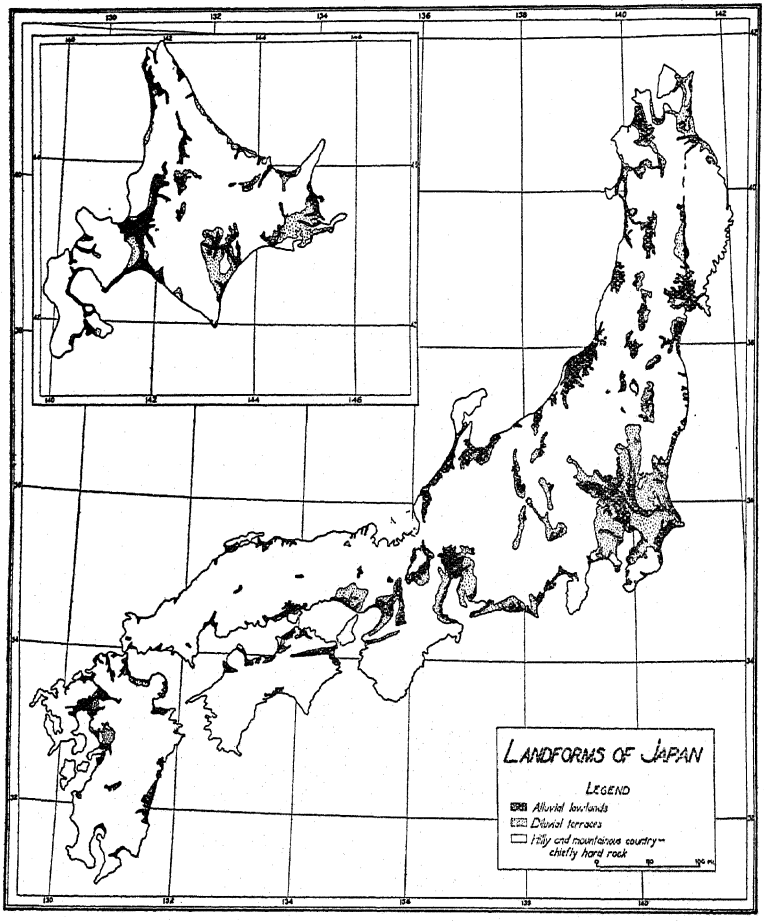


FIG. 2.—Practically all Japanese lowlands are plains of aggradation. Hard rock areas are characteristically hill country or mountains.

A thick core of moderately rugged hill land and mountains, containing numerous tectonic depressions, with a narrow and discontinuous perimeter of diluvial terraces and less elevated delta-fans—such is the gross geomorphologic pattern of Japan. Roughly 75 per cent of its area is hill land or mountains where slopes are usually too steep and soils too thin for normal cultivation.[2] As a result of recent and rapid uplift, with associated vigorous ablation, the rounded landforms and deep regolith cover typical of mature climatic landscapes in the rainy subtropics (Cfa), do not predominate throughout the rugged interior of Japan. It is more especially where granite prevails that rounded cupola features, covered with a thick crust of weathered rock, are common; elsewhere angular forms and steep slopes are not unusual. Fault and flexure-scarps are conspicuous features and commonly serve as boundary lines between the geomorphologic subdivisions. Scores of volcanic cones in various stages of activity as well as dissection, providing some of the highest elevations of the archipelago, together with their associated lava and ash plateaus, are both widespread and strikingly prominent. Tertiary strata, (sandstone, shale, conglomerate, tuff) which have widespread distribution throughout the country, are geographically significant, first, because they are the sources of much of Japan's mineral wealth, more especially coal, and second, because certain series of the Tertiary are weak and poorly consolidated, forming characteristically low, thoroughly dissected hill country of moderate slopes and considerable valley-floor area.

The mountain streams are short, swift, shallow and in general unnavigable; have limited drainage basins and narrow valleys with restricted flood plains. Alluvial and diluvial terraces are conspicuous features of their valleys. Of small use for transport, except possibly for logs, the mountain streams are principally significant as sources of hydro-electric power and irrigation water for the populous plains. Detritus-choked tectonic basins, their floors a series of terrace levels, and along their margins coarse-soiled alluvial cones, often forming irregular piedmont zones, are characteristic of large parts of the Japanese mountain lands.

[2] K. Oseki states that only 26.5 per cent of the country has slopes of less than 15°. See *Scott. Geog. Mag.*; 31, 1915, 440-465 and 519-531. Approximately 15 per cent of the total area was under cultivation in 1931.

Nippon lacks extensive plains and those diminutive ones which lie within her borders are almost exclusively surfaces of aggradation. There are no extensive structural plains underlain by undisturbed strata and covered with residual soils, such as characterize the Mississippi drainage basin. Hard rock areas in Japan are practically coincident with hill land and mountains. The typical plain of Nippon is a small isolated patch of riverine and wave-worked sediments developed in a coastal indentation or a mountain basin. The largest of these is the Kwanto or Tokyo Plain, roughly 2,500 square miles in area. Lowlands are dominantly peripheral. Seldom is the alluvium continuous along the coast for any distance due to frequent interruption by hills and mountains as they come down to the oceans' margins. To the eye most of the delta-fans are essentially flat, but this impression is seen to be erroneous when one beholds the relatively strong flow of water in the rivers and in the irrigation canals. The streams on the lowlands are for much of the year shallow and braided, flowing in extraordinarily broad, bowlder and gravel-filled channels,[3] flanked on either side by natural and man-built levees. The latter precaution is necessary both because of the violent flooding nature of the streams, as well as their characteristic habit of flowing at or even somewhat above the general level of the surrounding plain. Lack of depth, as well as their much divided channels, causes them to be of little use for navigation, but at the same time their elevated beds make gravity irrigation a simple matter. The seaward margins of the alluvial lands, especially where they front upon the open ocean, are commonly bordered by beach ridges, the outer ones capped with dunes. These littoral features of beach ridges and dunes are especially well developed on the Japan Sea plains of North Honshu where the full force of the winter monsoon gales is felt.

The inner margins of the delta-plains often terminate abruptly, with no marked increase in slope, at the bases of the encircling foothills. Where rivers debouch onto a plain the transition is made less abrupt by the presence of coarse-textured alluvial fans or cones, sometimes completing a piedmont belt. In other places the descent from mountain to plain is broken by

[3] During the growing season for rice, they often appear nearly dry because of the subtractions made for irrigation.

intermediate steps in the form of sand and gravel terraces, remnants of uplifted ancient coastal plains, or delta-fans, designated as *diluvium*. Less frequently these benches are wave-cut platforms covered only with a veneer of gravel and sand. The diluvial terraces are conspicuous features in Japan because of their distinctive form, extensive area, and widespread distribution. The fact that they are found in almost all parts of the country from Hokkaido to Kyushu has led one group of geomorphologists to infer rather general and contemporaneous uplift of the entire archipelago. Usually they form low upland platforms standing out several scores, or even hundreds, of feet above the adjacent new alluvium. Vertical downcutting by streams is rapid in these unconsolidated fluvial sediments, the resulting topography characteristically exhibiting shallow canyon-like valleys with flat to gently sloping interstream uplands. The latter feature is often a remnant of the original depositional surface, the relatively smooth sky lines of the terraces being a distinguishing characteristic of their profiles when seen from a distance. Less common is the diluvial terrace which has been so intricately carved as to present a typical bad-land landscape.

Japan Proper has a remarkably long coastline (17,000 miles, or 1 linear mile of coast to 8.5 square miles of area)[4] in proportion to its area. With the exception of western Kyushu, the shoreline facing Asia is relatively smooth and abrupt, even the outer margins of the delta-plains being bordered by wide belts of beach ridge and dune material. The Pacific Coast on the other hand is rich in large indentations such as Toyko, Suruga, Ise and Osaka Bays, all fault depressions with their long axes in general north-south. The famous Inland Sea, with its numerous islands and ocean-connecting channels, similarly is a zone of depression. In the quiet waters at the heads of some of these large bays have collected relatively extensive alluvial deposits upon which have gathered the greatest nodes of urban and rural population in Japan. Along the entire coast line, vertical oscillations of somewhat less magnitude have resulted in some stretches of subsiding littoral with small indentations, and others, where as a result of emergence, wave-cut and depositional terraces overlook narrow strips of recently exposed coastal plain.

[4] The ratio is 1 to 13 for Great Britain.

Along the whole length of Japan Proper from Hokkaido to Kyushu there are two parallel zones of contrasting geological structure, the one on the Pacific side of the arc known as the "Outer Zone," that on the Asiatic side, the "Inner Zone." Fault scarps and tectonic depressions mark the contact between the two except in the great Mountain Knot of Central Honshu where the arrangement of the principal features is confused and complicated. In the Outer Zone there is a tendency for the geological formations to have a more regular arrangement and conspicuous development; complicated structure, with less regular arrangement of strata and an abundance of eruptive rock characterize the Inner Zone.

The Honshu Arc may be still further subdivided into unlike northern and southern halves by the great depressed zone (Fossa Magna of Naumann) which traverses the mid-part of the main island from the Pacific Ocean to the Sea of Japan. It appears as though the mountain arc were bent backward along this fracture and the resulting rift subsequently filled, in part at least, by younger strata and great volcanic piles. A series of local structural basins occupies positions at the bases of the fault scarps. Along this depressed zone runs the Fuji volcanic chain, with magnificent cones, among them Fujiyama, standing as boundary posts, separating the two morphologically unlike districts of northern and southern Japan.

Thus based upon geologic and geomorphologic contrasts, Japan may be subdivided into four zones, "North Inner," "North Outer," "South Inner" and "South Outer." See insert map, fig. 1.

The Outer Zone of Southwest Japan, designated as the Pacific Folded Mountains, is separated from the Inner Zone by a line of great dislocation, with which are associated several graben valleys and a conspicuous fault scarp, extending from central Honshu through Kii Peninsula, and Northern Shikoku to western Kyushu. The Pacific Folded Mountains are characterized by well developed longitudinal ridges and valleys in parallel arrangement, trending northeast-southwest, each formation separated from the other by longitudinal dislocation lines. They are generally high and rugged and contain few plains of conspicuous size. The predominant rocks are crystalline schists and older sedimentaries greatly folded and contorted. Granites and younger volcanics are rare. Minerals are largely of the bedded replacement type, copper being most important. In central Honshu this Outer Zone is represented by the High Akaishi Mountains (Akaishi Sphenoid) terminating on the east in a bold fault scarp overlooking the Fossa Magna. Declining gradually in elevation, the Pacific Folded Mountains are continued westward in the southern parts of Kii Peninsula, Shikoku and Kyushu, submarine subsidence basins isolating them into separate mountain masses. In southern Kyushu the Outer Zone is intersected by the Ryukyu or Luchu Arc, resulting in a southern appendage of volcanic materials consisting of an ash plateau, volcanic cones and lava flows.

In contrast to the Outer Zone, the Inner Zone of Southwest Japan is a series of dissected block plateaus. Slope prevails throughout, variations in relief causing some parts to be genuinely mountainous although more of its area is rugged hill country. Granite is abundant so that rounded forms and slopes covered with a whitish crust of weathered rock are more typical here than they are in any other subdivision of Japan. The geological structure and physiographic history are extremely complex. Ancient sedimentary rocks pierced by granitic intrusives have been peneplaned, cut by a complicated system of fault lines, some of the resulting blocks suffering upheavel, and others depression. Throughout most of the area fault block structures with associated tectonic valleys and basins are common. Volcanic activity is relatively wide-spread. The highest elevations are in central Honshu where the Hida Range (Japanese Alps) with some peaks exceeding 3,000 meters, terminates abruptly at the tremendous fault scarp overlooking the Fossa Magna. Farther west in Chugoku Peninsula, northern Shikoku and northern Kyushu, elevations are lower, relief less, and the landscape is hilly rather than mountainous. The Inland Sea, enclosed between Chugoku, Shikoku and Kyushu, together with its channel outlets to the open ocean, occupies depressed zones, the western end of the Inland Sea subsidence area being filled with volcanic material forming the ash and lava plateaus of North Kyushu.

The northern half of Japan (north of the Fossa Magna) is composed of three parallel chains of north-south mountains or hills separated from each other by structural depressions. This distinctive linear and parallel arrangement of ranges and depressed zones is lost toward the south where they all coalesce to form the Mountain Knot of Central Honshu.

The Outer Zone (Pacific) of North Japan is separated from the Inner Zone by a line of tectonic depressions extending from the Ishikari-Yufutsu lowland in Hokkaido, southward through the Mabechi, Kitakami and Abukuma valleys, and finally terminating on the south in the bay-head plain of Kwanto. In places this series of depressions has fault-scarp margins; in others, flexure scarps. Gneisses, crystalline schists, and older sedimentaries, together with notable amounts of intrusives, are characteristic. Five separate segments of highland compose it: the Kwanto and Ashio blocks forming the western margins of the Kwanto Plain, and not conspicuously separated from the Inner Zone; the two spindle shaped highlands of Abukuma and Kitakami farther north in Honshu, and the Hidaka mountains of eastern Hokkaido. In general they all have the appearance of uplifted, tilted and dissected peneplains with complicated structure. In Hokkaido the Outer Zone is intersected by the Kurile Arc resulting in the great volcanic piles which characterize the central and eastern part of that island.

Two parallel ranges of hills and mountains, separated by a

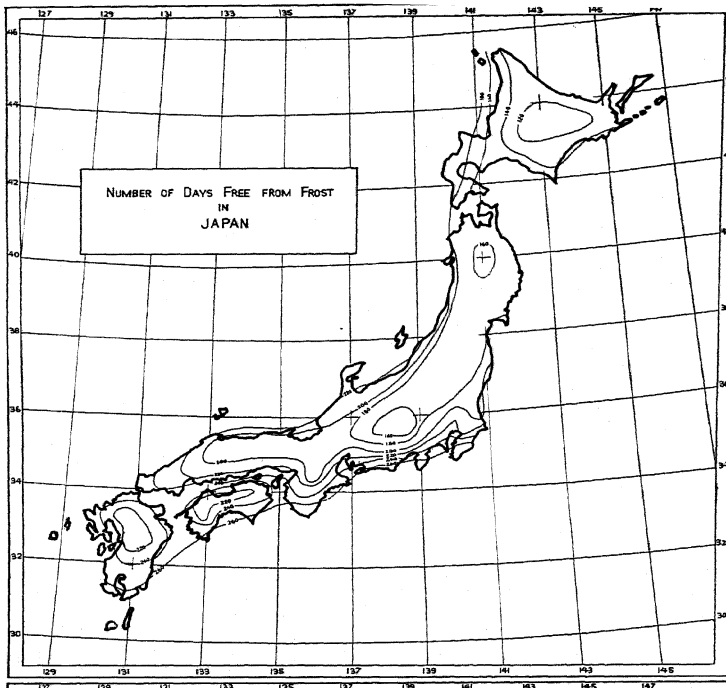
series of detritus-floored fault basins, comprise the Inner Zone (west) of North Japan. The mountains are enlongated domes with flexure scarps along their margins. The central range, which is the backbone and watershed of northern Japan, is composed chiefly of recent sedimentary strata overlying a core of gneiss and granite and capped with volcanic cones which have greatly altered the original features of the mountain. It is a continuous range through northern Honshu, forms the northernmost knob of Mutsu Peninsula (Honshu) and the eastern volcanic portions of Peninsular Hokkaido. The western range is similar geologically to the central one but is more variable in altitude. Several streams, draining the western basins, cross it in antecedent valleys, their deltas forming plains of variable size along the Sea of Japan, some of them in calderon-shaped depressions partially occupied by volcanoes.[5]

2. Climate, Vegetation and Soils

a. Climate.—Japan's climate is a peculiar compromise between continental and marine elements with the former predominating. Extending as a mountainous archipelago from 45°N. to 31°N. (approximately mid-Maine to extreme southern Georgia) latitude alone produces marked contrasts between north and south. Intricate surface configuration and marked differences in altitude superimpose conditions making for conspicuous local variations. Japan's proximity to the eastern margins of Asia, although separated from this greatest of land masses by several hundred miles of water, assures Nippon in one season of being directly in the path of the persistent and vigorous outblowing winter monsoons, and in the opposite season of receiving the milder and more intermittent indrafts of warm humid air from the southern Pacific. Thus Nippon comes under the influence of the seasonal "centers of action"

[5] Conversations with Mr. A. Watanabe of the Department of Geography, Tokyo Imperial University, who accompanied me in the field, did much to clarify my knowledge of Japan's landforms. An unpublished manuscript on Landforms of Japan, written by Mr. Watanabe, with the aid of R. B. Hall, was a further help. This manuscript has since been published in, *Papers of the Michigan Academy of Science, Arts and Letters.* For further details see the following references:

1. Naomasa Yamasaki: Geographical Sketch of Japan, *Scientific Japan Past and Present*, pp. 1-32. Prepared in connection with the Third Pan-Pacific Science Congress, Tokyo, 1926.
2. Manjiro Watanabe: Geological Distribution of the Important Ore Deposits in Japan, *Economic Geology*, 18, 1923, pp. 173-189.
3. H. Yabe: Problems Concerning the Geotectonics of the Japanese Islands; Critical Reviews of Various Opinions expressed by Previous Authors on the Geotectonics, *The Science Reports of the Tohoku Imperial University*, Sendai, Japan, Second Series (Geology), Vol. IV, No. II, 1917, pp. 75-104.
4. Robert Burnett Hall and Akira Watanabe: Landforms of Japan, *Papers of the Michigan Academy of Science, Arts and Letters*, Vol. XVIII, 1932, pp. 157-207.



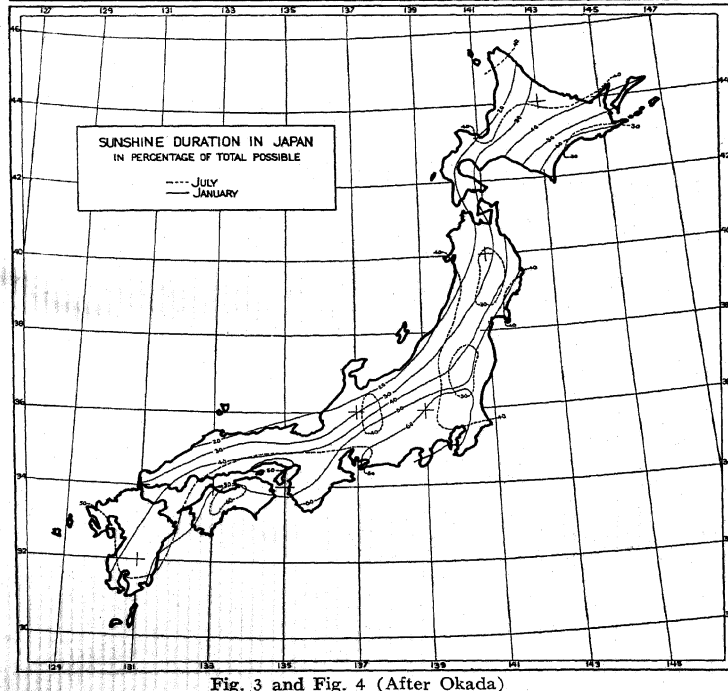


Fig. 3 and Fig. 4 (After Okada)

developing over eastern Asia and the North-Pacific Ocean. Variations in position, intensity and shape of these semi-permanent "centers," making themselves felt through the shifting winter storm tracks, appear to offer a basis for long-range forecasting of the winter weather of Nippon.[6] In spite of its insularity, and with the Japan and China Seas acting as buffers against invasions of cold air from Asia, winters are slightly colder in Japan than in similar latitudes along the American Atlantic Seaboard, while summer temperatures on the other-hand are nearly identical,[7] although the time of maximum heat is somewhat retarded in Nippon, August being hotter than July.

The non-periodic weather element in Japanese climates, as controlled by moving cyclones and anticyclones, is relatively well marked, accent being upon winter and spring. In winter the storms appear to come from the Yangtze region of Central China and move in a northeasterly direction, following both the Japan Sea and the Pacific littorals of Nippon, the two tracks finally uniting in Hokkaido. Spring storms, as well as originating in the Yangtze Basin, seem to come from the Manchurian-Siberian latitudes, with again a convergence of tracks on Hokkaido. Summer and autumn storms, although they are fewer and move more slowly, have much the same tracks as do the spring storms, with the exception that in late summer and early fall violent tropical hurricanes make themselves felt in subtropical Japan.[8] From mid-June to about mid-July there is a high frequency of relatively weak, slowly moving cyclones, probably of convectional origin, emerging from the hot, humid Yangtze valley and moving slowly north-eastward, or even stagnating, over subtropical Japan. Relatively large amounts of cloudiness, abundant rain, high humidity and high sensible temperatures, characterize this very uncomfortable and gloomy period of the so-called Bai-u or plum rains.[9] The early summer rainfall max-

[6] R. Sekiguti, K. Taguti, and T. Taguti: On the Characterization of Winter, *Memoirs of the Imperial Marine Observatory*, II, No. 1, Kobe, 1925.

[7] Kagoshima in far southern Japan has similar seasonal temperatures to Montgomery, Alabama; Tokyo in mid-Japan to Raleigh, N. C., and Sapporo in Hokkaido to Oswego, N. Y.

[8] Dr. Coching Chu: A Preliminary Study of the Weather Types of Eastern China, *Proceedings of the Third Pan-Pacific Science Congress*, Tokyo, 1926, Vol. II, pp. 1366-1385. For tracks of cyclones over Japan, see, Bartholomew's *Atlas*, Vol. III, Meteorology, Plate 28.

[9] T. Okada: On the Bai-u or Rainy Season in Japan, *Bull. of Central Meteorological Observatory of Japan*, No. 5, Tokyo, 1910.

imum of subtropical Japan is associated with this seasonal concentration of "Bai-u" storms.

More continental than marine in its temperature characteristics, because of its east coast location in a region of strong monsoons, winters are prevailingly 10° to 20° too cold for the latitude while summers, although closer to the normal, are predominantly hot and sultry. Seasonal ranges of temperature are therefore relatively large. In January there is little difference in temperature between the Pacific and the Japan Sea Coasts, but the latitudinal gradient is steep, a change of approximately 2.6°F. for each latitude degree, which is nearly identical with that (2.5°) of the American Atlantic Seaboard. Since humidity

TABLE 1
Seasonal Temperatures for Representative Latitudes

	Lat.	Jan.		Aug.		Range
		Av.	Mean of daily min.	Av.	Mean of daily max.	
Asahigawa	44°N	14	1.4	69	79.5	55
Tokyo	36°N	37	29.5	78	85.6	41
Kagoshima	31½°N	45	37.2	80	87.6	35

is high and winds inclined to be strong, especially on the side toward Asia, the cold is penetrating and uncomfortable particularly at night or when the sky is overcast. Although the warm northward flowing Kurosiwo current is bifurcated at the southern extremity of Kyushu, the main stream parallels the Pacific Coast at least as far north as latitude 36°, while a much smaller amount of warm water enters the Japan Sea through the Korean Straits. In winter therefore the principal mass of warm water is on the leeward side of the archipelago and is as a result, relatively ineffective in meliorating the low temperatures of the northwest winds. The latitudinal summer temperature-gradient is much weaker (1° per lat. degree), being only about two-fifths that of winter. High temperature, combined with poor ventilation, except along the coasts, and high humidity, make the summer heat of sub-tropical Japan extremely enervating and uncomfortable. Most foreign residents and many Japanese as well trek to high altitude or seacoast resorts in summer exactly as do whites in tropical locations. The cool Okhotsk current which in summer parallels the east side of Hokkaido and Honshu down to about latitude 36° or 37°,

causes those coasts to be definitely cooler and also somewhat foggier than inland valleys or west coasts in similar latitudes. The length of the frost-free season[10] varies from 120 days in central Hokkaido to 260 days along the extreme southern and eastern littoral. There is a strong tendency for the isopleths of frost-free days to parallel the coasts, so that land-and-water control is quite as conspicuous as latitude.

Unlike sub-humid North China and Manchuria in similar latitudes, Japan is a humid land with no parts suffering from a yearly deficiency of rainfall. Generalizations regarding areal distribution of precipitation are extremely difficult to make because of remarkable local contrasts due to relief, which cause the rainfall map to appear very confused and patchy. In general there are two extensive regions of heavy precipitation (80-120+ inches), one on the Pacific side of the archipelago from Kyushu northward almost to Kwanto (lat. 35°) and the other in western Honshu north of 35° or 36°. Three regions with annual precipitation as low as 40-50 inches are: Hokkaido, the graben basins of central Honshu and the Inland Sea borderlands. A seasonal, as well as a total deficiency of rainfall is absent in Japan, there being no Köppen Cw or Dw climates such as prevail on the adjacent continent. Warm-season rains prevail over the southern and eastern two-thirds of the country. Not infrequently two secondary maxima are conspicuous, one in early summer at the time of the "Bai-u" rains (except in Hokkaido) and the other in late summer and early autumn, the season of typhoons. Winters are far from dry.

TABLE 2

Precipitation in Inches for Tokyo on the Pacific Coast, and Fukui in a Similar Latitude but Facing Asia.

	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Tokyo	2.0	2.6	4.3	5.3	5.9	6.3	5.6	4.6	7.5	7.2	4.3	2.3	57.9
Fukui	11.5	7.9	6.5	5.8	5.6	7.4	8.0	5.8	9.1	6.8	8.6	13.4	96.4

On that side of the archipelago facing Asia, from Hokkaido nearly to the southwestern tip of Honshu, the vigorous on-shore winter monsoons and the cyclones produce a cool-season precipitation maximum, a considerable part of it falling as snow. In January the Japan Sea littoral has wind velocities 2-3 times as strong, and a sunshine-duration only one-third to one-half as

[10] Number of consecutive days free from hoar frost.

great, as that along the opposite Pacific coast. In July these coastal contrasts are not discernable. On the lowlands there is generally a permanent snow cover along the Pacific side of the country only down to latitudes 37° or 38° while on the side facing Asia snow remains on the ground nearly as far south as Kyushu, and is often several feet deep in latitudes north of 36°.

According to the Köppen system of classification, and based upon the available published data, Japan Proper has only two major types of climate, Dfb in Hokkaido and Cfa throughout all of lowland Japan south of Tsugaru Straits, only three isolated mountain stations falling within the Cfb boundaries. Certain it is, however, that much of highland Japan south of latitude 42° is likewise Cfb or Dfb, although data are lacking for the high altitudes.[11]

b. VEGETATION. Japan was originally a wooded country, and even today 60 per cent of its area, principally the high and rugged lands, are classed as forest covered, although some 15 per cent of the area so defined is actually "wild land" or "genya," bearing a mantle of wild grasses, shrubs and bushes. The prevalence of a luxuriant vegetation mantle covering the slopes throughout the mountain region adds greatly to the beauty of the landscape. Japanese appreciation of trees is nowhere better exhibited than in the preservation of the magnificent groves of stately cryptomeria which surround temples and shrines, the nation's holy spots. Possible recent changes of climate, together with long occupance of the region, and consequent intervention by a civilized people, have resulted in great confusion within the present vegetation cover, which contains, besides the original, many recent, relict and cultivated types. As a result any delineation of vegetative zones is attended with considerable difficulty and various botanists prefer different groupings and combinations.[12] Distinctive and remarkable features of the Japanese flora are the great variety of forms and the inclusion in it, at various latitudes, of elements belonging to much warmer regions. By most botanists this is interpreted as

[11] For a very detailed description and classification of Japan's climates see, E. Hukui: Climatic Division of Japan, *Geog. Rev. of Japan*, Vol. IX, 1933, pp. 1-19, 109-127,195-219, 271-300. Map opposite page 271.

[12] Mrs. O. N. Mikhailovskaia: On the Soils of Japan, *Contributions to the Knowledge of the Soils of Asia*, Academy of Sciences of the U. S. S. R., Vol. I, 1930, pp. 9-30.

indicating recent climatic oscillation. Heavy undergrowth is characteristic of Japanese forests, reflecting coincidence of heavy rainfall and high temperatures during the vegetative period.

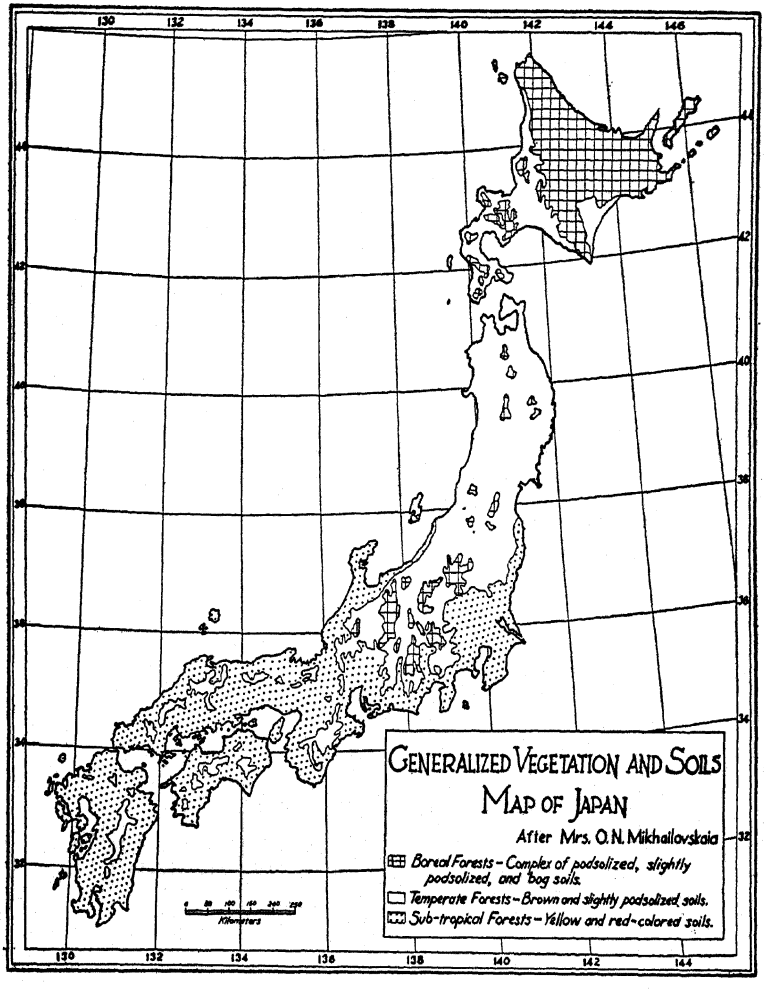


Fig. 5

Three general latitudinal forest zones are here recognized: (a) The *Subtropical Forest Zone* descends to sea level at about latitudes 37° or 38° and, except for high elevations, includes

all of southwestern Japan where the mean annual temperatures lie between 55° and 70°F. The original vegetation consisted of broad-leafed evergreen trees (*Boxus sempervirens, Quercus ilex, Quercus silva, Quercus vibrayeana, Quercus abuta*) and remnants of these forests still survive in the isolated mountain districts of Kyushu and Shikoku, but due to careless cutting, conflagrations, and partial reforestation, there has been a large intrusion of deciduous broad-leafed species, (*Quercus serrata, Quercus glandulifera*) and pines (*Pinus densiflora, Pinus thunbergii*). Oaks predominate and are the most widely used of the broad-leafed trees. Several varieties of bamboo, which grows in small groves rather than covering extensive contiguous areas, the Japanese tallow or wax tree (*Rhus succedanea*), and the camphor tree (*Cinnamomum camphora*) are species common to the sub-tropical forests which have special industrial uses. In extreme southern Kyushu are found numerous tropical elements, both among the trees as well as among the plants which comprise the forest underwood. Here palms and banana trees are conspicuous. According to the soil map of Japan by Mrs. Mikhailovskaia, yellow (*zheltozems*) and red (*krasnozems*) soils, thoroughly leached of their basic elements, are coincident with the zone of sub-tropical forests.

(b) The *Temperate Forest Zone* includes Honshu north of latitude 37° or 38°, southwestern Hokkaido, and certain higher elevations south of latitude 37°—all of them regions where the mean annual temperature varies between 43°F and 55°F. Broad-leafed deciduous forests and stands of mixed hardwoods and conifers comprised the original floral cover. Deciduous trees still predominate in numbers although the conifers are commercially more important and greatly outnumber all others in the planted woodlands. Mixed forests are most common. In autumn the rich yellow and red foliage colorings of maple, birch, beech, poplar, oak and other deciduous trees, especially when shot through with the dark green of the needle varieties—fir, pine, hemlock, cedar—create a gay landscape. Among the conifers the most valuable trees are: Japanese cypress (*Chamaecyparis obtusa, Chamaecyparis pisifera*), arbor vitae (*Thujopsis dolabrata*), Japanese cedar (*Cryptomeria japonica*), and fir (*Abies firma*). Of the broad leafed trees, keyaki (*Zelkowa*

acuminata), beech (*Fagus sylvatica*), ash (*Fraxinus mandschurica*), chestnut (*Castenea vulgaris*), poplar (*Populus tremulus and balsamifera*), and oak (*Quercus dentata*) are of greatest commercial value. Within this temperate zone of deciduous and mixed woodlands are included the larger part of Japan's economic forests. It is the realm of the brown soils (*burozems*) these being replaced by slightly podsolized types at higher elevations.

(c) In northern and eastern Hokkaido where the average annual temperatures are below 43°F is the *Zone of Boreal Forests* where conifers predominate, principally fir (*Abies veitchii, Abies sachalinensis*) and spruce (*Picea ajanensis*). A great variety of broad-leafed deciduous trees which are of small value for timber are also present in either pure or mixed stands. Undergrowth is thick and dead timber clutters the forest so that penetration is not easy. Many of the river valleys are wet tundra-like areas. A complex of podsolized, slightly podsolized and bog soils coincides with the zone of boreal forests.

In spite of the fact that nearly 60 per cent of Japan's area is classed as forest covered, the country does not produce enough lumber for domestic consumption, nearly 20 per cent of the requirements being imported, largely from the United States, Canada and eastern Siberia. The remaining large stands of natural forest are either in the more recently settled areas of the north (Hokkaido, and Aomori and Akita prefectures in Northern Honshu) or in the mountainous and least-accessible parts of Old Japan (the highland mass of Central Honshu and the folded-mountain regions of Kyushu and Shikoku). Reforestation has been in progress for over 50 years and substantial results have been obtained. Two of the largest areas of artificial forests are (1) the basin of the Yoshino in eastern Shikoku where there are 200,000 acres of cryptomeria and Japanese cypress, and (2) the Tenryu basin in Central Honshu, with over 100,000 acres composed of similar trees. For the past decade or more, in the neighborhood of 400 square miles have been replanted annually, the area devoted to conifers being ten times that to broad-leafed deciduous varieties. An American is impressed by the plots, both large and small, of geometrically arranged trees in various stages of growth, mantling the hill and mountain slopes.

In Japan there are four primary forms in which wood is consumed—pulpwood, lumber, firewood and charcoal, the value of the last two products being two thirds again as valuable as the lumber, reflecting the almost universal use of charcoal and wood as do-

mestic fuels. Since dwelling houses are almost always of wood construction, the timber required for building purposes absorbs nearly one half the total consumed. Eighty six per cent of the lumber is from conifers while broad-leafed varieties are preferred for charcoal. Pulpwood for rayon manufacture is imported from abroad, while that for paper manufacture is produced in Karafuto and Hokkaido. In 1929 Japan produced 3.7 per cent of the world's pulpwood.

The present distribution of timber, firewood and charcoal production is very widespread, but with Hokkaido, which contains over one third of the lumber resources of Japan, taking first rank. Very emphatically, forestry is an industry of the hill-and mountainlands, such locations involving difficult methods of logging and transport, since many rivers are not satisfactory for rafting. To a considerable extent forest products form the principal source of cash income for settlers in the highland districts, who till the soil in summer and cut wood and burn charcoal in the winter. Around their residences are commonly to be seen numerous bundles of firewood and charcoal, waiting transport to the market on the lowlands.

TABLE 3
Value of Forest Products in Japan
1931*

Timber	13,596,523 cu. m.	63,509,863 yen
**Conifers	11,051,058 " "	54,556,176 "
Broad-leaf	2,545,365 " "	8,953,687 "
Fuelwood	50,118,480 " "	43,533,840 "
Bamboo	5,005,507 bundles	2,850,214 "
Charcoal	18,303,461 100 Kg.	59,365,991 "

* The Statistical Abstract of the Ministry of Agriculture and Forestry, 1931-32. Ministry of Agriculture and Forestry, Japan, 1933.
** Over one half from crytomeria and red pine.

c. Soils. Japanese soil experts in general are of the opinion that the climatic classification of soils is not particularly applicable to Nippon and are inclined to ignore it entirely, using in its stead a geognostic system. The most recent scheme of soil classification in Japan, officially endorsed and accepted, is based upon texture, parent rock, and topography and contains no terminology relating to climatic processes of soil formation.[13] This attitude is not so unusual when one reflects that the country is composed principally of hill lands and mountains with steep slopes, lowlands of new alluvium, and recently ash-cov-

[13] Keijiro Aso and Toyotaro Seki: New Schemes of Soil Classification and Soil Surveying in Japan, *Proceedings of the Third Pan-Pacific Science Congress*, Tokyo, 1926, Vol. II, pp. 1955-1959.

Sixteen soil maps, (scale 1:500,000) cover all of Japan Proper excepting Hokkaido. At least five have already been published. Texture of soils is shown in colors, while geological formations, age and petrographical characteristics are designated by signs. Soils rich in gravel or humus are indicated.

ered uplands, none of these locations favoring the development of mature soil profiles. Nevertheless although Mrs. Mikhailovskaia[14] in her scheme of latitudinal soil belts is probably guilty of forcing a coincidence between climatic, soil and vegetation boundaries and thereby presenting an ideal rather than a reality, there is too much truthfulness and value in it to allow it to be ignored. The generalized climatic soil types coinciding as they do with the forest belts, have been mentioned therefore in the discussion of vegetation zones.

Among the geognostic soil types, in Japan as in the other monsoon lands of southeastern Asia, new alluvium is held in highest esteem, and it is therefore on the floodplains and deltas that human life is concentrated. It is not only their generally high fertility, so that they are conspicuous by contrast in a region of generally infertile residual soils, but also their low, flattish surfaces and the ease with which they can be irrigated, that recommends these alluvial sites. Considerable diversity of soil quality exists on the delta-plains. The beach-ridges along their seaward margins are commonly sandy while adjacent to present or even relict river channels, coarser texture is frequently observable. Where fan configuration is conspicuous, soils of the upper slopes are not only coarse but often stony. Due to the small size of the plains, their rugged hinterlands and the abundance of coarse-mineraled rocks such as granite, the alluvial soils of Japan are inclined to be generally porous and light in texture, a prized soil quality in a region of heavy rainfall and inundated crops.[15] The old alluvium (diluvium) of the terraces is not only often coarse in texture, with droughty sand-and-gravel subsoils, but is likewise well leached, showing ruddy colorings typical of mature soils in these climates. Young volcanic ash, still in process of being deposited, which mantles many of the terraces, as well as forming volcanic uplands of some extent, is on the whole infertile, being very deficient in basic minerals and nitrates although its physical properties are usually not bad. As a rule, nitrogen is the most used manure in Japan.

Because of the complicated nature of the earth materials

[14] Mikhailovskaia: On the Soils of Japan. *Op. cit.*

[15] Dr. P. J. S. Cramer: Notes on Agriculture in Japan Gathered During a Voyage in 1924, *Communications of the General Experiment Station for Agriculture*, No. 22, Buitenzorg, Java; pp. 6-15.

and the landforms composing the hilly and mountainous hard-rock portions of Japan, no summary of their soil characteristics is here attempted. Largely to prevent damaging floods, and resulting deposits of coarse detritus on valuable farm lands of the lowlands, great care is taken to keep the hill slopes well mantled with vegetation. By sad and costly experience Japan has learned the danger of denuded slopes, and a vigorous and scientific campaign against soil denudation is being constantly waged. Check dams and artificial terraces, as well as soil fixation by restoration of the vegetation cover, are common methods employed.[16] "Protection forests," maintained to prevent soil denudation, at present cover 883,177 hectares.[17]

[16] W. C. Lowdermilk: Torrent and Erosion Control in Japan, *American Forests and Forest Life*, 35, August 1927, pp. 474-479.

[17] In addition to the references cited in the footnotes, the following are particularly valuable:

1. Climatic Atlas of Japan and Her Neighboring Countries. Central Meteorological Observatory, Tokyo, 1929.
2. T. Okada: The Climate of Japan. *Bull. of the Central Meteorological Observatory of Japan*, IV, No. 2, Tokyo, 1931, pp. 89-416.
3. Forestry of Japan, Ministry of Agriculture and Forestry, Tokyo, 1926.

B. THE CULTURE OR OCCUPANCE FEATURES

Occupied by a civilized people for 2,000 years,[18] the Japanese Archipelago bears an indelible imprint of long tenure, not only in terms of purely man-made features but in altered natural ones as well. The present landscape is an incongruous one in many respects, with a base composed of feudal oriental forms upon which have been hastily and unconformably superimposed, elements of a modern machine-age, occidental civilization. Only three quarters of a century ago Japan was still an isolated "hermit nation" with a feudal organization of its society. The country was ruled by the Tokugawa shoguns in Yedo (Tokyo) while several hundred military nobles or "daimyos" held practically the whole of Japan in fief, dividing it economically into scores of isolated and self-sufficient states. The daimyos surrounded themselves with large retinues of "samurai" or professional warriors and lived in feudal fashion in moat-encircled castles with extensive grounds. During the late feudal period Japan was an isolated country composed of isolated units. Population even as late as 1850 was less than one half what it is today, and had remained practically stationary for over a century. Internal and external trade were almost negligible; railroads were unknown; not a single ship did the country possess which could cross an open ocean; agriculture was primitive; industry was exclusively handicraft; silk production was not sufficient to meet the home demands; large cities were rare; Hokkaido was practically an empty wilderness.

With the abolition of feudalism, the restoration of the Emperor, and the opening of Japan to occidental influences after the middle of the last century, there began a series of rapid transformations, political, social and economic, which have made of Nippon, in certain respects, a modern industrial, financial and commercial nation, with concomitant landscape changes.[19] Population has more than doubled, several great

[18] C. W. Bishop: The Historical Geography of Early Japan, *The Geg. Rev.*, Vol. 13, 1923, pp. 40-63.

[19] Dr. Ludwig Mecking: Japan's Häfen, ihre Beziehungen zur Landesnatur und Wirtschaft, *Mitt. Geogr. Gesell. in Hamburg*, Vol. 42, 1931, pp. 31-70.

industrial and commercial cities with definite western features have come into being; modern commercial and fighting fleets have been evolved; over 12,000 miles of railway have been laid, internal and foreign trade are of first class magnitude. Seldom has there been a complete metamorphosis however, and especially throughout rural Japan the indigenous culture still predominates. It is in the larger cities that the clash of native and occidental forms is most conspicuous.[20]

1. Population: Density and Distribution

In 1930 the population of Japan Proper was 64,450,000[21] (probably 66,000,000 to 67,000,000 in 1933 at the time of writing) a density of 169 per sq. km., or 438 per sq. mi., ten to eleven times that of the United States and exceeded only by three industrial countries of Western Europe. This figure is scarcely a measure of real density however since, because of mountainous relief, so little of the total area is significantly occupied, only 15 per cent being under cultivation in 1931. Substituting *cultivated area* for *total area* in the denominator of the ratio, population density is then 2,913 per sq. mi., higher than in the industrial countries of Europe[22] while in Nippon at least one-half the total population is dependent upon agriculture. If only the agricultural population is considered the density is still 1,369 per sq. mi. or less than half an acre per member of each rural family. Japan's basic national problem is in one which concerns the supporting of an already dense and rapidly increasing population within a small territory poor in fundamental resources. From 1925 to 1930 inclusive, the yearly increase in population has been between 900,000 and 1,000,000, reflecting an extraordinarily high birthrate.[23]

Almost any map of population densities, but especially

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[20] For a thorough treatment of the economic history of Japan see Yosoburo Takekoshi: *The Economic Aspects of the History of the Civilization of Japan*, 3 vols.; New York, 1930.

[21] Résumé Statistique de L'Empire Du Japon, Tokyo, 1932.

[22] Great Britain 2,170, Belgium 1,709, Italy 819, Germany 467, United States 229. See Harold G. Moulton, *Japan: An Economic and Financial Appraisal*, Washington, D. C., 1931, p. 22. In Great Britain only 7 per cent, United States 26 per cent, and Germany 31 per cent of the population is engaged in agriculture. See John E. Orchard, *Japan's Economic Position*, New York, 1930, p. 182.

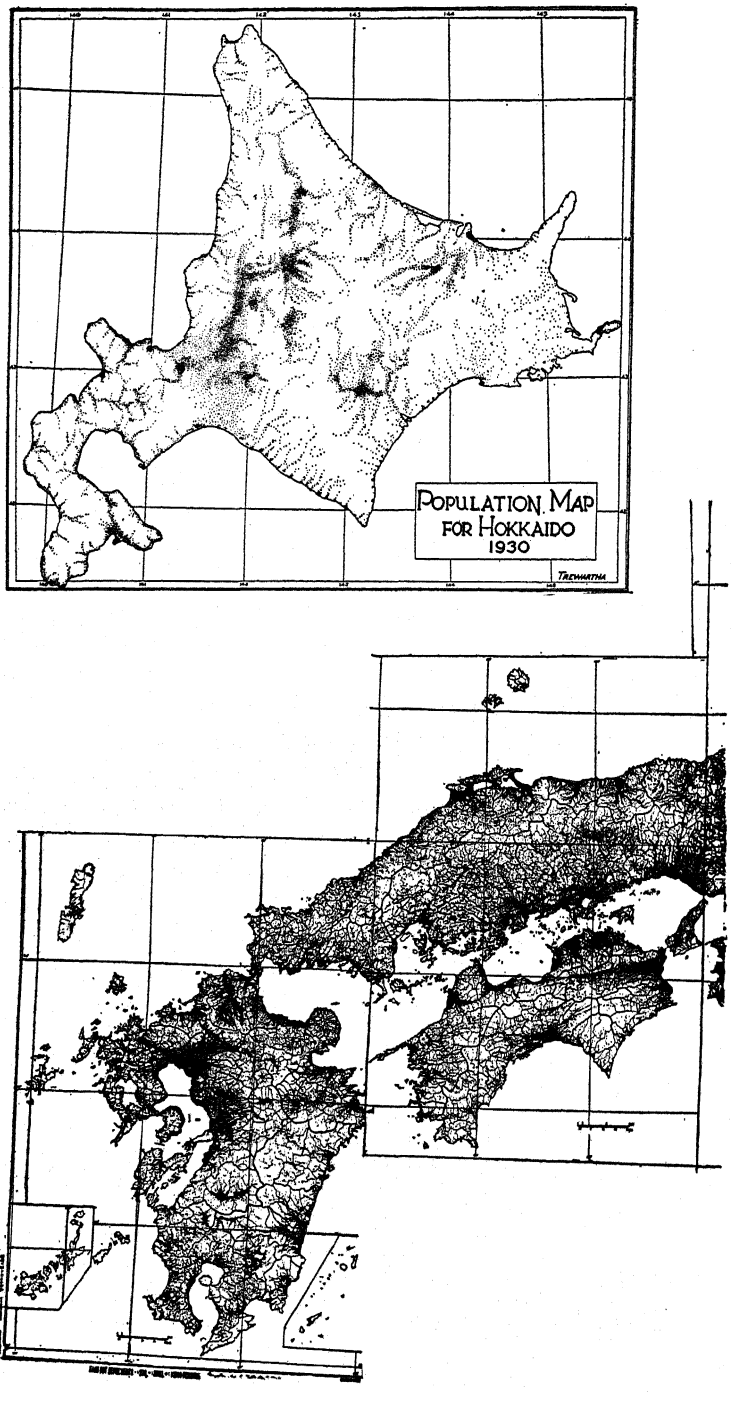
[23] A birth rate of about 32.25 per thousand in 1930.

Ishibashi's[24] which expresses densities for small political subdivisions (gun) by means of ratios, reveals the fact of a general decrease in population with increasing latitude north of about 37°. Thus while Hokkaido has only 32 persons per sq. km., and the three northern prefectures of Honshu only 80, most of the prefectures in southwestern Japan average between 100 and 400 per sq. km., depending upon variable proportions of mountain and plain. If to eliminate this influence of relief, cultivated land is substituted for total area, the same decrease northward is evident, for considering the density of the southwestern prefectures (those without large cities) as the datum plane or 100, then southern Ou in latitudes 37° or 38° has a density of 65 to 80, northern Honshu 45 to 65, and Hokkaido 25 to 35. This decrease northward reflects increasing remoteness from the economic and political heart of Japan as well as a more severe climate which makes living conditions harder and agricultural land less productive, because of a declining yield in rice, smaller amounts of winter cropping and fewer commercial crops such as mulberry, tea and citrus.

South of latitude 37° there is a distinct concentration of population along the Pacific side of the country in an irregular zone extending from the Tokyo Plain on the north, along the Pacific Coast (excluding Kii Peninsula) to Osaka and including both shores of the Inland Sea and northwestern Kyushu. This is one of the first settled as well as the most urban and industrial part of modern Japan, and contains as well the nation's ancient capitals, and the modern centers of business and commerce. Here are relatively large alluvial plains facing on the quiet waters of spacious bays where great industrial port cities have developed. The whole region is easily accessible, its deeply

[24] The two outstanding population maps of Japan are by:
1. K. Tanaka and K. Yamamoto: A dot map of Japan Proper omitting Hokkaido (Scale 1:1,000,000.) Data for 1925. Five sheets.
2. G. Ishibashi and T. Ono: Densities per sq. km. by small political subdivisions, are shown in color for the entire Japanese Empire. (Scale 1:1,000,000). Data for 1920.

See also:
3. Mark Jefferson: The Distribution of People in Japan in 1913, in *The Geog. Review*, II, No. 2, 1916, pp. 368-373.
4. Wesley Coulter: A Dot Map of Distribution of Population in Japan; in *The Geog. Review*, XVI, No. 2, pp. 283-284.
5. John E. Orchard: The Pressure of Population in Japan; in *The Geog. Review*, XVIII, No. 3, July 1928, pp. 374-401.
6. H. Tanakadate and others: Distribution of Population in Northeast Japan. Scale 1:800,000. Densities per sq. km. for smallest political subdivisions (villages). Sendai, 1926.
7. L. Mecking: Japan's Siedlungsräume, *Mitt. der Geog. Gesellschaft in München*, vol. 24, 1931, pp. 193-210. Map based upon Tanaka's and Yamamoto's map.


POPULATION MAP
FOR HOKKAIDO
1930
TREWARTHA

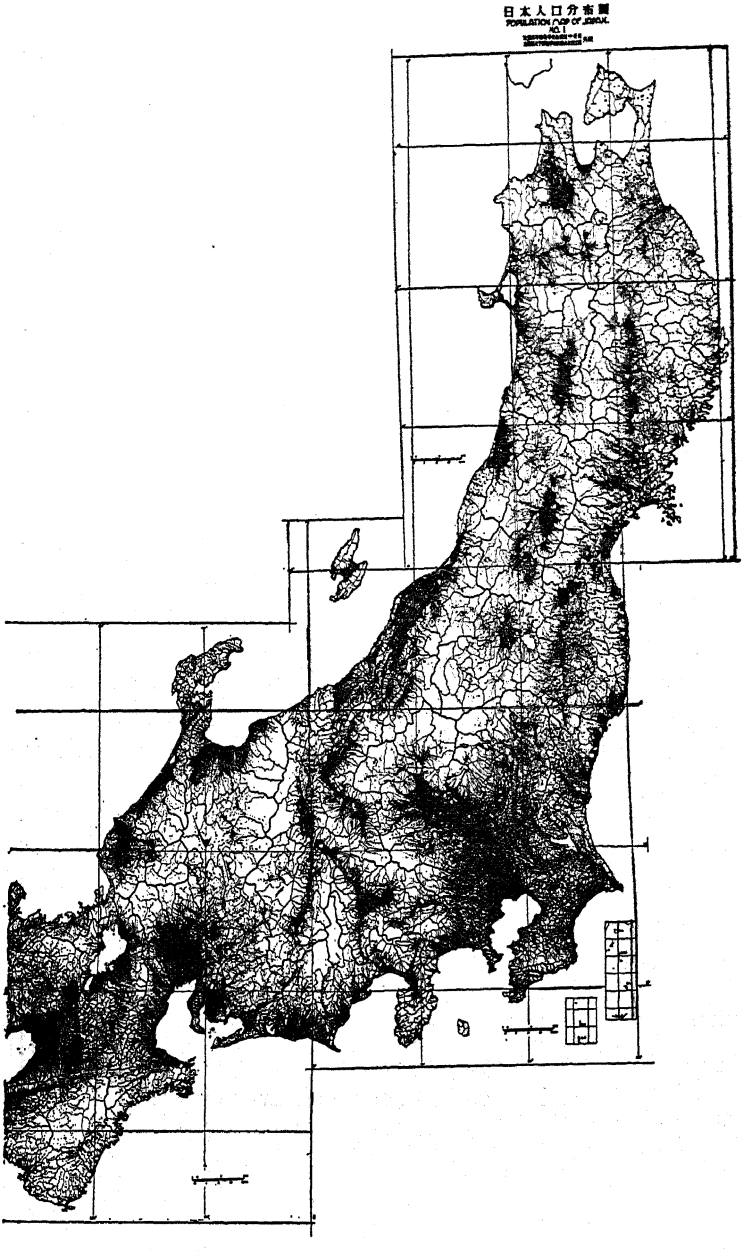


FIG. 6.—*Population distribution in Japan.* Nippon's population is concentrated upon plains of new alluvium. Much of the hilly and mountainous land is relatively barren of settlement. Compare with Fig. 2. (Japan Proper from map by K. Tanaka and K. Yamamoto; data for 1925. Hokkaido by the author; data for 1930. One small dot represents 200 people.)

indented coastline bordering protected waters offering numerous havens for boats. At its western end is the nation's most utilized coal field. All six of Nippon's great metropolitan centers (over 600,000 population), five of them occupying tidewater locations, are included within this populous belt, as are 41 of the remaining 66 cities with over 50,000 inhabitants.

A very discontinuous, fragmented, or clotted population pattern is conspicuously characteristic of Japan, the compact settlement clusters being almost perfectly coincident in both size and shape with detritus-floored lowlands.[25] Very sharp, almost knife-edge boundaries frequently separate densely populated areas from those which are nearly vacant of settlement. One can with considerable accuracy reconstruct the relief from a detailed population map. In a few instances smooth ash uplands and low, much dissected Tertiary areas have significant settlement. Such close spatial coincidence between plains of river aggradation and human life makes for an emphatic peripheral or seaboard concentration of population since most of Nippon's lowlands are delta-plains. It is not unusual therefore that its inhabitants are closely bound to the sea. This coincidence between alluvium and population is perhaps more emphatic in Nippon than in most parts of the world because of the insistence of Japanese farmers upon growing irrigated rice. In the hill-lands this rice obsession leads to close correspondence between population and drainage lines. In a region of such complicated geomorphology, it almost goes without saying that population patterns are numerous, varied and complicated. As in China, so in Japan, there is a tendency to overcrowd the best lands and to avoid too completely the less fertile and more isolated upland locations. In part this may reflect the gregarious nature of the Japanese and their dislike for frontier isolation. In the case of China, Baker[26] believes the avoidance of less productive lands reflects the inability of a farmer, under conditions of spade agriculture, to obtain a living from any but the best land. The same reasoning probably applies for Japan since only 40 to 45 per cent of the agricultural household possess a work animal. A man with a spade and a hoe cannot turn more poor land than

[25] See L. Mecking: Japan's Siedlungsräume, *op. cit.*, pp. 204-208.
[26] O. E. Baker: Agriculture and the Future of China, *Foreign Affairs*, April 1928, pp. 3-17

good land and hence it behooves him to spend his energies on the most productive soil.

2. House Types and Settlement Forms

A. Houses.—To an occidental, accustomed as he is to colorful substantial buildings of stone, brick, or wood, frequently surrounded by green lawns and shade trees, the Japanese house is likely to be disappointing. It is unsubstantial in appearance and inexpensive to build, characteristics which are not at all out of place in a poor country where the climate is relatively mild. The representative house is a small unpainted wooden structure of one or two stories. Unlike the Chinese and Koreans who constructed of brick, clay and stone, the Japanese have always built of wood, and this in spite of frequent and disastrous conflagrations. There is no excavated basement. A continuous foundation is lacking, the uprights of the framework usually resting upon single stones pounded into the earth. The first floor is usually 1½ to 2 feet above the ground, some houses having the appearance of standing on stilts; in others the wall boards descend nearly to the ground. The external walls are usually either of thin wood siding, unpainted and weather stained, or wattle, covered with mud-and-straw plaster, either in natural color or whitewashed. The whole outside appearance inclines toward being dull and lacking in color. Often two or more sides of the house have no permanent walls but only sliding wooden screens so that the dwelling can be thrown wide open for ventilation during the long hot summer. Excellently adapted to hot weather, the Japanese house is cold and drafty in winter. Glass windows are usually lacking, translucent paper substituting for glass in the sliding doors and outside screens or "shoji." One writer has aptly likened the typical residence of Nippon to a huge lantern. Within the house there are few permanent partitions, the rooms being marked off by sliding screens and floored with thick reed mats called "tatami." The ponderous roofs of thatch (sometimes two feet thick) and gray tile strike one as being out of proportion to the frail houses which support them. Crude wooden shingles are not uncommon in parts of the country but less common than thatch in the rural areas, or than tile in the larger villages and cities.

Along sea coasts or other windy and exposed areas the shingles are often held in place by rows of heavy stones. Thatched roofs, which are typically Japanese, are most picturesque, the great variety in design and structure of the ridges tending to relieve the monotony characteristic of a collection of Japanese houses. In parts of southern Nippon each of the various provinces seems to have developed its own peculiar style of ridge.[27] In some instances it is flat and supports a luxuriant growth of bright colored flowers. Chimneys are conspicuously absent. In comparison with thatch, the dull slate colored tile roofs of the larger villages and cities, where the danger of fire is greater, are somber and wanting in charm. Lacking livestock, except perhaps a horse or ox, the rural dwelling does not have a conspicuous barnyard containing numerous detached sheds and outbuildings. See plate 19.

The urban house where it is not a combination of small retail shop and dwelling, as is commonly the case, is likely to have a close and prisonlike aspect to a foreigner. If it abuts upon the street there is little display of architectural beauty on the street side and windows are often protected by gratings. The better class of dwelling is set slightly back from the road and enclosed by a high and forbidding wooden wall which is entered by a barred gate. Within the wall a formal miniature garden is the rule. In newer residential sections of many cities a few modified foreign-style houses and apartment buildings are beginning to appear.

B. RURAL SETTLEMENTS.—Since Japan is so emphatically an agricultural nation[28] it is to be expected that rural settlement forms predominate. Moreover, since the farm family ordinarily resides in a village and not in the midst of its fields, the compact village or town of 500-10,000 inhabitants, rather than the isolated farmstead, is the most typical residential unit of rural Nippon. Over 60 per cent of Japan's people are in semirural agglomerations with fewer than 10,000 people. While some of the smallest communities may be composed almost exclusively of tillers, most of the towns contain not only farmers, but

[27] See, Edward S. Morse: Japanese Homes and Their Surroundings, New York, 1904; also Robert Burnett Hall: Some Rural Settlement Forms in Japan, *The Geog. Review*, XXI, No. 1, Jan. 1931, 93-123.

[28] 50-55 per cent of the population is dependent upon agriculture.

TABLE 4
Communities Classified According to Their Populations, 1925

Size of Population group	Number of communities	Total population	Per cent of population
**Less than 500	82	26,103	0.04
501- 2,000	2,545	3,854,410	6.45
2,001- 5,000	7,050	22,532,803	37.72
5,001- 10,000	1,733	11,470,200	19.20
10,001- 20,000	392	5,229,161	8.75
20,001- 50,000	145	4,437,992	7.43
50,001-100,000	51	3,444,916	5.77
100,001-200,000	15	2,132,245	3.57
200,001-400,000	.....	.....	.....
400,001-500,000	1	405,888	0.68
More than 500,001	5	6,203,104	10.38
Total	12,019	59,736,000	

* Résumé Statistique de L'Empire Du Japon, 1932, *op. cit.*, p. 7.
** I cannot harmonize this figure with the considerable number of isolated farmsteads. This type of settlement appears to be omitted from the table.

artisans, tradesmen and representatives of the professions as well.

Variations in town characteristics are not absent, yet to a foreigner they have many features in common. In the larger and more compact ones the absence of shade trees is conspicuous. In general they are without brightness and color, the closely-set unpainted houses being monotonously alike, especially where tile roofs prevail. No church spires relieve their even skylines. Grass is absent. At night they are ablaze with light for recent years has seen an almost complete electrification of Japan. For a given population the compact town of Nippon occupies less space than one in the United States, because of its narrower streets and close spacing of dwellings, the structures often abutting against one another as they do in our commercial districts. In most villages, distinct and compact commercial cores and residential districts do not exist, many of the streets combining both functions, for the dwelling and the shop are one, the shop occupying the street side while the family lives in the back or second story rooms. Each shop is usually specialized in a single type of product, e.g., fish, eggs, hardware, paper, liquor, cloth, etc. Sliding doors allow the whole front of the little store to be entirely open facing the street, so that all of its wares are conspicuous to the passers-by. The streets are narrow and appear to be always crowded, pedestrians, bicycles, human and animal-drawn carts and playing youngsters,

all jostling one another. Sidewalks are rare, pedestrians using the street which is usually macadamed but not smooth. Open drains or gutters carrying drainage or refuse water (not sewage) from the residences line both sides of the street. Local dug wells commonly provide the homes with water.

Settlement Locations and Sites.—In the mountains, for the very obvious reason of transportation advantages, villages occupy the valley floors. In these locations as well are the only patches of near-level alluvium, with water for irrigation, where the precious rice crop can be readily cultivated. If the lowest part of the valley floor is subject to serious inundation an adjacent terrace bench or the slopes of an alluvial fan may furnish more ideal sites.

The less extensive diluvial terraces, especially if they are considerably elevated and separated from the alluvial plain by abrupt slopes, often have few villages, their cultivated lands being worked by agriculturists residing on the alluvial plain below. Where they are of considerable area, as on the Tokyo Plain, or less elevated, villages may be relatively numerous on the diluvial uplands as well. On the terraces as well as in the mountains there is a tendency for dispersed settlement to be more common.

Very definitely, however, rural towns are concentrated on the plains of recent alluvium. If the lowland is not too wet and subject to inundation, villages dot its surface at sufficiently frequent intervals so that the farmer is not compelled to travel excessive distances to his scattered plots of land. To such villages, surrounded as they are by inundated rice fields, the road takes on the importance of a bridge and may in a large measure determine the settlement form. Other than those settlements, widely and generally distributed over a plain and associated with roads in both cause and effect relationships, there are others which occupy typically strategic sites. These are usually associated with elevations or dry sites which have the dual advantage of saving the settlement from occasional inundation as well as providing superior locations for transportation lines, rail and highway. Three such elevated dry sites, on or adjacent to the paddy-covered lowlands are: (1) beach ridges paralleling the coast, (2) river dikes, either present or relict, and (3) the

contact zone between the wet alluvium on one hand and the hard-rock foothills and diluvial terraces on the other. The first and third types as well as providing dry points in an otherwise wet plain, have the additional attraction in that they are adjacent to both rice land and dry-crop land, it being desirable for a farmer to cultivate both types. The beach-ridge location has a further advantage in its proximity to the ocean, and its settlements are frequently combination agricultural-fishing villages.

Rural Settlement Forms.—No general summary of the various Japanese settlement types and their distribution is yet available although selected forms have been described[29] for certain parts of Japan. One of the most widespread village types is the "strassendorf," or an approximation of it, where the linear dimension greatly exceeds the width. Not infrequently it is a single row of houses extending for a mile or more along either side of a main road. Some of the longest examples of this type are those villages along a highway paralleling a narrow strip of coast between the mountains and the sea. Where this form occurs on a low plain in the midst of inundated rice fields, or on a well drained diluvial upland, it is obvious that the road alone is the cause for the village shape. But many such shoe-string settlements, perhaps a majority of them, occupy elevated dry sites such as beach ridges and levee tops where the landform itself has acted in conjunction with the highway along its crest, to induce an elongated shape. Villages occupying such elevated sites are commonly bordered on either side by strips of dry fields.

Another prevalent settlement form is the compact village or "haufendorf," often with a general checkerboard street pattern. In some parts of Japan the nuclei of such settlements have grown up within walls and moats, most of which have disappeared as expansion has taken place. Other "haufendorfs" are simply nodal developments at intersections of local travel routes. Such compact villages are particularly suited to paddy areas where cooperative effort is required.

The disseminated pattern of rural settlement is the prevail-

[29] Hall: Some Rural Settlement Forms in Japan, *op. cit.* H. Sato: Distribution of "Strassendorf", (In Japanese), No. 39, *Essays in Memory of Dr. N. Yamasaki, Geog. Rev. of Japan,* VI, No. 7, July 1, 1930, pp. 550-557; M. Odouchi: Settlements, in *Encyclopedia of Japanese Geography* (In Japanese), Vols. I and II, pp. 242-255.

ing type only in newly-settled Hokkaido, where the arrangement of isolated farmsteads often coincides with the rectangular road pattern. In "Old Japan," south of the Straits of Tsugaru, the disseminated pattern is less common and is found principally in a few type locations, such as, (1) hill country, particularly the low dissected Tertiary hill lands; (2) ash and diluvial uplands; (3) certain steep alluvial fans, and (4) the recently reclaimed outer margins of advancing deltas. Certainly in some, if not most, of these cases the empirical explanation is recency of occupance although Japanese geographers are uncertain if or why this is true with respect to some alluvial fans. Unlike Hokkaido, the arrangement of isolated homesteads in Old Japan is usually without definite pattern. More common, I believe, than one would judge to be the case from the usual descriptions, is a semi-dispersed or amorphous type of settlement which is transitional in character between the compact town and the isolated farmstead. In these loose agglomerations a definite street pattern is lacking and the widely-spaced, straggling residences, separated by fields, are connected only by irregular foot paths or cart paths.

c. URBAN COMMUNITIES.[30] Throughout the greater part of its history Japan has been emphatically a rural nation largely without numerous important cities. Even at the close of the 19th century, when the total population had reached 44,000,000 there were only 78 urban communities whose populations exceeded 20,000. The next quarter century, however, saw an accelerated industrial and commercial expansion within Nippon and a concomitant urban growth as well, so that by 1925, there were 217 cities containing over 20,000 people, their combined populations totaling nearly 28 per cent of the country's 59,000,000 inhabitants. In that two and one-half decades while total population increased 34 per cent the number of cities increased 178 per cent. Japan was rapidly becoming more urban.

Origins.—It was not until the latter part of the Middle Ages, with the establishment of a feudal system of society and the division of Japan into fiefs ruled over by local sovereigns, or daimyos, that conditions became propitious for the develop-

[30] In portions of this discussion I have drawn freely from Ludwig Mecking: Japanische Stadtlandschaften, in *Stadtlandschaften der Erde,* herausgegeben von Siegfried Passarge, Hamburg, 1930, pp. 109-123. See also Odouchi, *op. cit.*, pp. 242-255.

ment of cities. The centripetal force acting to concentrate population was the castle-housed daimyo surrounded by the quarters of a large group of professional warriors, the samurai. At least three advantages were furnished by such centers: they were strategic markets; they furnished a degree of protection in a period when internecine warfare was a scourge, and they offered opportunities for amusement and entertainment that the country village did not. Thus most of the first large towns and cities had their origin as strategic political-economic centers of small semi-independent feudal empires. Artisans and traders flocked to these daimyo cities, and in a number of instances a center became so specialized in some feature of trade or manufacture as to acquire national fame. So firmly established did these specializations become that certain ones have persisted even to the present time. Takekoshi[31] in his recent work on the economic history of Japan indicates three additional types of city origins in feudal Nippon other than those settlements clustered about castles. They are: (1) Temple and shrine cities to which merchants and traders were attracted by the market advantages offered by the thousands of worshippers visiting certain famous religious centers. (2) Critical post stations containing numerous inns, located along important highways, these relay stations also offering peculiar market advantages. Many of the post-stations however, were combined castle-towns and hostelry centers such as for instance was Shizuoka on the famous Tokkaido highway. (3) The free ports and markets, which were not under the control of any lord or group of priests, but rather were ruled exclusively by the merchants who inhabited them.

I have no exact data by which a precise comparison can be made of the number of cities having one or more of these four origins. Certain it is however, that the castle cities greatly outnumbered the others. When Shogun Hideyoshi's land survey was made in the last decade of the sixteenth century there were 160 fiefs, each with its own lord and capital city. At the time the Tokugawa shoguns were establishing their capital at Yedo (Tokyo) a quarter of a century later, there were 197 feudal lords, all except two of them having definite fiefs. Eight great

[31] Takekoshi, *op. cit.*, pp. 243-245, and 358.

Shinto shrines and eight similarly important Buddhist temples were also recognized by the Tokugawa shogunate, but the combined revenues of these, plus those of the numerous others scattered throughout the provinces were less than two per cent of those of the feudal lords.[32] The number of free ports was never large, the total being only 10 in the year 1500.[33] It is evident therefore that the nucleus of a large majority of these feudal towns and cities was the daimyo's or sovereign's residence.

At first the castle was a simple frame house surrounded by turf-covered earthen embankments in the form of steps or terraces, protected and made more durable by wooden piles. It was not until after the introduction of European firearms that radical departures from this simple type of structure were made. Under Portuguese direction the first castle having European earmarks was constructed in 1575. It was at this time that heavy flared walls of cut stone, usually andesite or granite, pierced by several protected gates, began to supplant earthen terraces or embankments, and encircling moats were added as a further item of defense. The residence itself, however, still remained simple and Japanese in type. These extensive wall and moat-protected grounds, in size and massiveness quite out of proportion with other Japanese structures, were, and still are, conspicuous features in the drab and crowded cities. They have been the cores around which accretion has taken place. Today the grounds of these feudal relics are most commonly occupied by military barracks or schools, providing an environment in which both children and soldiers may absorb the spirit of Japan's romantic past when daimyo princes and their samurai warriors ruled Nippon. Few, if any, of the original residences remain, as numerous fires have razed the wooden structures repeatedly. Commonly the daimyo's castle occupied some sort of elevation such as a hard-rock outlier or spur of diluvium, a type of site that made it doubly conspicuous and more easily protected. It was never very far removed from the low alluvial plain, however, for the encircling moats must be filled with water, and this was usually possible only where the ground water was near the surface. Moreover, nearness to the seacoast was considered

[32] *Ibid.* pp. 418-419; 527-534.
[33] *Ibid.* p. 373.

of some importance since in time of war it made more certain an uninterrupted supply of salt, manufactured from the sea water. A characteristic feature of the castle town was the offsets in the streets, causing numerous angles and jogs, this being a part of the defense plan.

In spite of the fact that the last half century has seen a remarkable growth in urban population, it appears that rela-

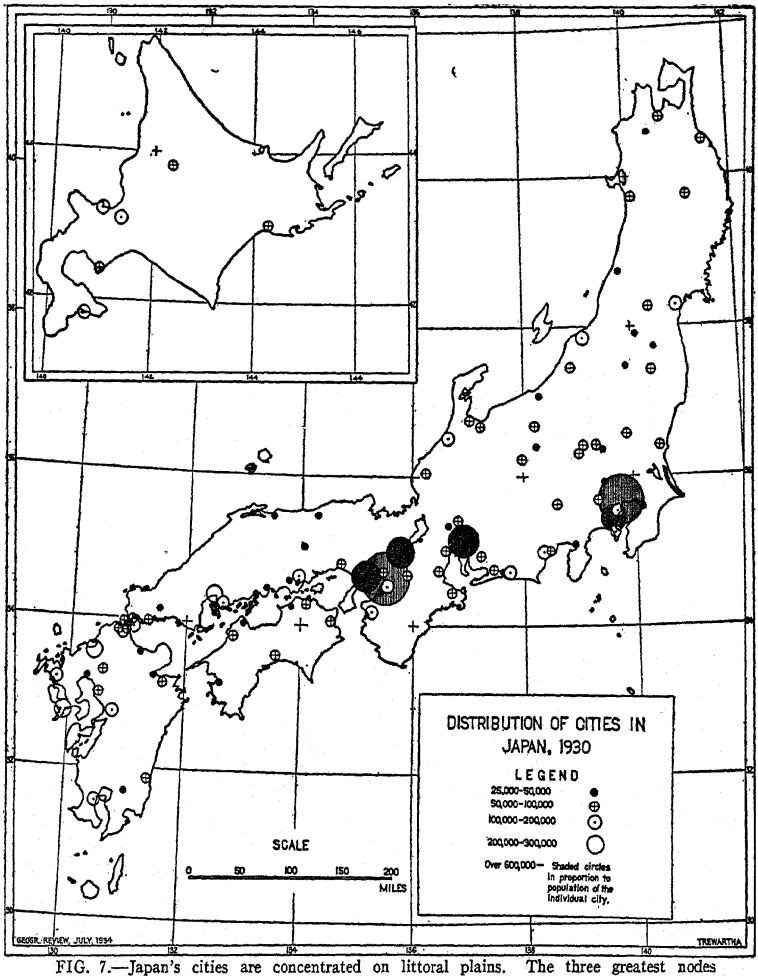


FIG. 7.—Japan's cities are concentrated on littoral plains. The three greatest nodes of city concentration are on the relatively large Tokyo, Nobi and Kinki plains, all of them aggradational in origin, which have collected in the quiet waters at the heads of tectonic bays. Tokyo's population, which was slightly over 2,000,000 in 1930, has been since then (October 1932) increased to over 5,000,000 by the inclusion of much peripheral territory within the city limits. (Plate furnished by the Geographical Review published by the American Geographical Society of New York.)

tively few large cities have actually been called into existence by the exigencies of the modern era. Chief among these cities are the great deep-water ports of Kobe and Yokohama, the new urban centers of semi-frontier Hokkaido and the industrial port cities of North Kyushu. Others, like Osaka, Nagoya, and Sakai, ancient in origin and fame, have been greatly expanded and altered during this era of industrial and commercial revolution.

Distribution and Location.—Of the 107 cities in Japan with populations of 25,000 or more in 1930, only six are in Hokkaido, the northern island, 15 in Ou or northern Honshu, while 86, or 80 per cent, are in old sub-tropical Japan south of latitude 37°. This latitudinal distribution, with increasing density of total population, and even more emphatically of cities, toward the south, reflects not only the unsuitability of Japanese ways of living to the more severe northern climates, but also an increasing distance from ancient and modern economic and political centers.

Within that part of Old Japan south of parallel 37° there is a marked concentration of cities within a much enlongated belt lying between Kwanto on the north and northern Kyushu on the south. This includes northern Kyushu, the Inland Sea borderlands, and the Pacific littoral from the eastern end of the Inland Sea to Kwanto. Of the 86 cities with over 25,000 people included within sub-tropical Japan south of Ou, 69 or 64 per cent of the nation's total, are within this belt. This concentration is not associated with any one particular advantage but more especially with historical antecedents and with easy accessibility by water. Within this much enlongated urbanized belt the greatest single cluster of cities, 13 in all, and including Tokyo and Yokohama, two of Japan's six great metropolises, is on Nippon's largest plain, Kwanto. Second in rank is the cluster of 11 cities in the Kinki region, occupying bay-head and graben plains at the eastern end of the Inland Sea. Within this cluster are Osaka, Kobe and Kyoto three more of the six metropolises. Nine cities, including Nagoya with nearly 1,000,000 inhabitants, are grouped on the lowlands surrounding Ise Bay. Within these three clusters, all associated with deep tectonic indentations and bay-head plains of some magnitude, are Japan's six cities with

over 600,000 inhabitants, her four greatest ports, and three of her four principal industrial nodes.

Of the 107 cities here being considered, 90 or 84 per cent are located on littoral plains of aggradation, while 60 to 70 per cent have tidewater locations. This peripheral concentration of population reflects not only the coastal nature of most Japanese lowlands but likewise the great dependence, especially in the prerailroad era, upon water-borne commerce. Interior cities are relatively few. Only 17 are genuinely inland, and located on interior basins that have no sea frontage. Six of these are in the meridional tectonic depressions of Ou, while four more are in local basins of that great transverse fracture zone designated as Fossa Magna. Most of these are strategically located on intercoastal land routes, formerly highways, now railways.

The sites of most urban centers are portions of these same low alluvial or diluvial plains where flatness of site and squat buildings make it nearly impossible to get panoramic or birds-eye views of settlements. Of the 21 cities with over 100,000 population in 1925, all were nearly exclusively on flattish littoral-plain sites. In contrast with conditions along the Mediterranean and Cornish coasts, where picturesque towns cling to the sides of declivities, Japanese settlements characteristically occupy flattish sites, and only a few like Nagasaki, Hakodate, and Kobe spread up the slopes. A number of cities, like Tokyo and Yokohama, have two distinct levels of occupance, the flat-

FIG. 8.—Skyline of a Japanese city. The flattish delta-plain sites and the general lack of tall buildings in Japanese cities make for even skylines. From Edward S. Morse: *Japanese Homes and Their Surroundings.*

tish tops of the diluvial terraces, and the lower alluvial and coastal plains, but the difference in elevation is not great.

Morphology.—From the viewpoint of cultural morphology two large groups of Japanese cities may be distinguished. The first comprises the six great metropolises or "national cities"—Tokyo, Osaka, Nagoya, Kobe, Kyoto, and Yokohama—with more than local hinterlands, whose populations are each in excess of 600,000 and on which there is a definite foreign imprint, especially throughout the business and industrial sections. In contrast with these stand the scores of other cities that are essentially Japanese in their features and to a considerable degree appear to be cast in the same mold. A great gap or unconformity separates the six metropolises from the several score smaller cities, as there are only three of them with populations of over 200,000 and none at all in the 300,000, 400,000, or 500,000 groups.

The Indigenous Cities.—With minor modifications, the indigenous Japanese city of 25,000 to 250,000 people has many landscape features in common with the over 8,000 smaller agricultural towns. To be sure their populations comprise fewer farm families, but taken as a group they are characteristically local business centers and ports, almost invariably on a railroad, and serving a restricted tributary area much as they did during the feudal period. Mecking comments on their functional similarity to the towns of feudal Germany. Not only the occupied sites, but the sky-lines as well are flattish. There is a dead levelness about the sea of somber slate-colored tile roofs and unpainted frame buildings that is absent in even small American cities. Water towers, church spires, and tall substantial buildings of brick and stone are lacking. Trees are largely absent. The color supplied by the painted residences or the building materials in an American city is missed. The flimsy, unpainted, weather-stained Japanese structures are totally lacking in color. Two features are often conspicuous because their height or mass sets them apart from the general monotony of sky line; one is the daimyo castle, with its extensive wall and moat-encircled grounds containing trees; the other the shrines and temples, the latter gaily painted.[34]

[34] Ludwig Mecking: Kult und Landschaft in Japan, *Geog. Anzeiger*, vol. 30, 1929, pp. 137-146. An analysis of landscape features related to the spiritual life of the country.

A prevailing rectangular grid of streets, often with a north-south, east-west orientation, characterized many of the early cities and is still a common feature of the old cores of many

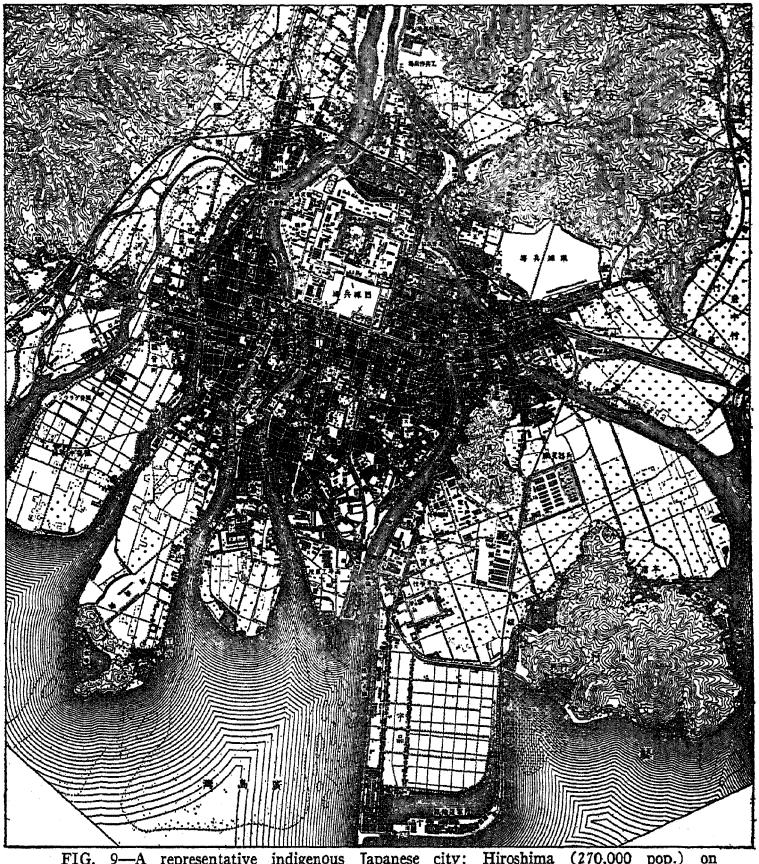


FIG. 9—A representative indigenous Japanese city; Hiroshima (270,000 pop.) on the shores of the Inland Sea. It occupies a flat delta site and is intersected by numerous distributaries and canals. Its core, around which accretion has taken place, is the daimyo castle grounds, shown on the map by the relatively open space in the north central part of the city. In the older part of the city, near the castle, there is a well developed grid of streets while in the peripheral sections right-angled intersections are not so common. From Japanese topographic sheet. Scale approximately 1:62,500. (Plate furnished by the Geographical Review published by the American Geographical Society of New York.)

modern ones. Two explanations may be offered for this street arrangement. Certainly the low flattish delta sites of most of the cities make such a grid arrangement feasible. This influence of the site is verified by the fact that where Japanese cities are on slopes the rectangular grid disappears or is modified. In these slope towns there is a tendency for one set of streets to

follow the contours or the water front with the other set crossing them at right angles. The other explanation has to do with Chinese influence, for that people who had produced the grid of Imperial Peking, made a very marked imprint upon things Japanese, including Nippon's cities. Imperial Kyoto and Nara are excellent examples of this Chinese influence. The rural highways, however, often are neither straight nor do they follow the cardinal directions; hence, as the city expands and encroaches upon what were agricultural areas, the street system built upon the original rural highway skeleton frequently loses the grid pattern and becomes confused. Thus there are numerous instances where the old core of a Japanese city is rectangular in street arrangement while its newer and often peripheral, sections are not. This is the reverse of conditions prevalent in many old American and European cities. The numerous and recurrent disastrous fires, common to Japanese settlements, have been a factor permitting frequent and widespread alterations of the original city plans. These changes are often revolutionary in their rapidity rather than of the usual slow evolutionary type of process. As an example, witness the drastic changes now in progress at Tokyo and Yokohama as a result of the earthquake and fire of 1923. Chronic fires as well as the universal habit of building of wood account for the almost total lack of ancient buildings.[35]

In their narrow, surfaced, but unpaved thoroughfares, numerous streets with combination residences and small shops, open gutters, and lack of sidewalks, the Japanese city bears a close resemblance to the rural town. Well defined and compact business cores are not nearly so destinct as in American cities of similar size. On the whole, foreign-style buildings are infrequent and where they do exist they are single and isolated and never form solid blocks. In exclusively residential sections each house is surrounded by a high and forbidding wooden wall so that such streets are quite without interest.

Composed as they are of small one-family houses, all much alike and closely spaced, often abutting against one another, it would appear on first thought that Japanese cities should occupy

[35] The general prevalence of conflagrations is due in large part to the closely-spaced, flimsy wooden buildings as well as to the universal use of open fires for heating and cooking. Until recently, paper lanterns with candles were the common form of illumination. In parts of the country fires are associated with earthquakes.

much less space than those of similar population in the Occident. This may be true of smaller urban centers, but the prevalence of multifamily apartment houses in European and American cities of over 50,000 probably corrects the discrepancy, in a measure at least. So uniform in size, spacing, and number of occupants are Japanese houses that it is said to be possible to calculate accurately the population of a city by knowing its dimensions.

Because of their delta locations, rivers and canals are common and conspicuous features of urban landscapes. They are arteries both of trade and commerce as well as of waste disposal. Factories, warehouses, and heavy retail establishments tend to congregate along their margins largely because of the cheap transport services that they offer for bulky goods, as lighters and sculled barges can bring wares from little tidewater ports to the very doors of the warehouses. The canals are usually not attractive because of both the kinds of establishments that border them and the refuse that they carry. As a corollary of the network of canals and rivers characteristic of so many Japanese cities, bridges are unusually numerous.

The Six Metropolises.[36]—The six great metropolitan centers of Japan, each with more than 600,000 inhabitants, as distinguished from the much larger group just described, are the only ones that have much more than a local sphere of influence. Their distinctive landscapes are the result, not of any new Japanese element, but rather of more complete westernization of their business, transportation and manufactural features. It is in the "downtown" retail business core that the stamp of foreign influence is most in evidence. Here there are solid blocks of large, substantial buildings, European in appearance, built of brick, stone and reënforced concrete. Nevertheless, the larger parts of their areas are still distinctly Japanese in aspect, with flimsy Oriental structures combining the functions of retail shops and residences, and fronting on unpaved thoroughfares. Narrow streets are still the rule although in all six of the large cities widening and paving of a number of the business thoroughfares have been accomplished, and in Tokyo and Yokohama ambitious new city plans are being executed.

[36] The best treatment of the five great tidewater cities is to be found in, Ludwig Mecking: Japan's Häfen, *op. cit.*

Traffic composition is most cosmopolitan, numerous taxis, motor buses, and tram cars contrasting strangely with the slow human and animal-drawn carts and the ubiquitous bicycle.

All six of Japan's great cities are on or near some of the largest of the country's alluvial plains that have collected in the quiet waters at the head of long tectonic bays. Each plain is a major focus of settlement that provides an important, populous, local hinterland. Only one, Kyoto, does not have tidewater location. Four of them compose the nation's quartet of greatest foreign-trade ports, while the fifth, Tokyo, although not an "open-port," is outstanding in domestic water-borne commerce. All are important rail centers as well. These same six cities are focuses of manufacturing within the three greatest industrial nodes of the country and so, with one exception, combine port and manufactural functions.

Based upon two items, location and function, these six cities may be divided into three groups. (1) The three largest centers, Osaka, Tokyo and Nagoya, each located at the head of its respective bay on the sea margins of advancing detla-plains are the business, industrial, and consuming centers of their large local hinterlands. (2) Kobe and Yokohama, the deep-water ports of the adjacent Osaka and Tokyo industrial nodes are located 15 to 20 miles down their respective bays where silting is not marked. The Nagoya, or Nobi plain at the head of Ise Bay has no representative in this port group. (3) Kyoto, the single representative of the third group, is an inland city, its principal fame accruing as a result of its having been for over 1,000 years the nation's capital. From a regional point of view, as shown by the previous analysis, four of Japan's great cities arrange themselves into two binuclear conurbations, Osaka-Kobe and Tokyo-Yokohama, the corresponding units in each pair having many locational, site, and functional characteristics in common.

3. Types of Production and Associated Landscape Features[37]

A. Agriculture.—Japan is a thoroughly agricultural nation with 50-55 per cent of its inhabitants directly dependent

[37] Forestry already has been touched upon under the heading of natural vegetation and consequently has been omitted from this section.

upon the land for a livlihood.[38] The density of agricultural population is approximately 1369 per square mile of cultivated land or about one half an acre for each member of a rural family. For the farming population, the representative settlement unit is the town of a few thousand inhabitants. All of the above facts have been touched upon previously but are broached here a second time for emphasis and summary purposes.

Closely identified in a cause and effect relationship with the large agricultural population and the restricted area of cultivated land is the small size of the Japanese farm, averaging 2.6 acres in area,

$$\frac{14{,}613{,}905 \text{ acres of cultivated land}}{5{,}633{,}800 \text{ farm families}} = 2.6.$$

Ninety one per cent of the farm units include less than 5 acres, 69 per cent less than 2½ acres, while only 1.3 per cent of the farm households cultivate more than 12.5 acres.

TABLE 5*
Number of Farm Households in 1931, classified by the Size of Agricultural Area under Management.
(One hectare = 2.475 acres)

Size of farm	No. of Farm Households
Under .50 hectares	1,941,488 (35 per cent)
0.50-0.99 "	1,933,172 (34 " ")
0.99-1.98 "	1,236,380 (22 " ")
1.98-2.98 "	319,747 (6 " ")
2.98-4.96 "	130,078 (2 " ")
4.96 hectares and over	72,935 (1 " ")
Total	5,633,800

* Statistical Abstract of the Ministry of Agriculture and Forestry 1931-1932, Table p. 3. Of the 5,633,800 farm households, only 1,756,399 cultivated their own lands exclusively, 1,495,310 were tenant farmers, the remainder, 2,382,091 cultivating their own lands and some leased land as well.

A cross section of Japan shows a gradual increase in the size of farm units from south to north but with considerable variation in individual prefectures, depending in part upon the amount of unirrigated upland (principally diluvial terrace and ash plateau) being cropped. Upland farms yield less than the irrigated paddy lands and are consequently larger. In southwest

[38] Thirty one per cent in Germany, 26 per cent in the United States and 7 per cent in Great Britain. Even in such countries as Argentina and Australia, agriculture is relatively less important. (See John E. Orchard, *Japan's Economic Position*, pp. 182-183.) Families engaged in agricultural pursuits are 47.1 per cent of the total in Japan, but the rural family is probably slightly larger than the urban family.

Japan, except in prefectures where there is an unusual amount of dry cropping, the farm units are generally under 2 acres in size, with some of the prefectures along the Inland Sea showing averages of 1.5± acres. In northern Honshu this figure has increased to 3½ acres, while in Hokkaido the average farm is 11 acres. The increasingly severe climate to the north with its shorter and less tropical summers, and with its more severe and snowy winters, makes for smaller production per unit area in the higher latitudes of Japan. Fall-sown cereals become less

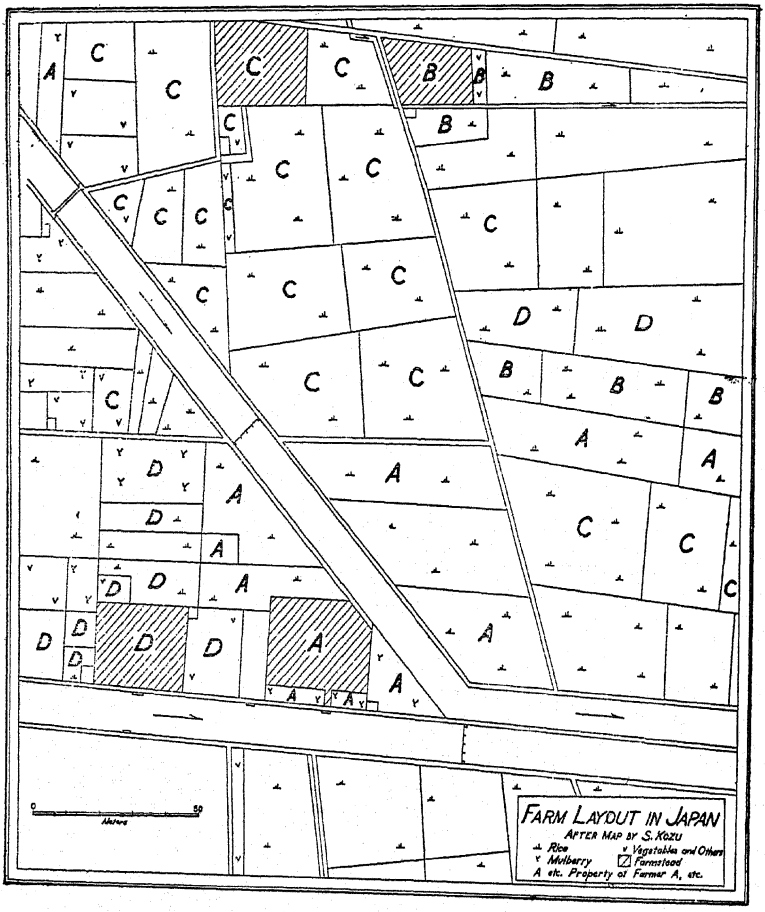


FIG. 10.—Small noncontiguous plots are typical of Japanese farms. In general the rural population resides in villages and towns, rather than on isolated farmsteads as they do in the section here illustrated which is a part of the Sanin coast near Matsue. Map prepared by Prof Kozu of the Normal School at Matsue.

profitable in northern, and especially in snowy northwestern, Honshu and finally disappear almost entirely in Hokkaido. Per unit-area rice yields are conspicuously lower toward the north. Such sub-tropical cash crops as tea and silk are not acclimated in Japan's northland, tea being of little importance north of the 37th parallel, and mulberry, the exclusive food for silk worms, showing a marked decrease north of 39° or 40°. This whole northern region is looked upon by the Japanese as less desirable country, well removed from the economic and cultural heart of Nippon and possessed of a climate which forces upon them certain hardships in living. In some years during the past decade, the number returning to the southern islands from Hokkaido has exceeded the number migrating into that Northland.

Unlike the American farm, which is usually a fence enclosed, compact and contiguous plot of land, the tiny Japanese farm is composed of several little unfenced parcels, scattered in various directions and distances around the village in which the agriculturist lives. This "open-field" system of unfenced scattered plots, corresponding to conditions in China and in parts of Europe, has resulted from centuries of renting, buying, bartering and inheriting. Each of the individual parcels of land is further subdivided into little fields of various sizes, shapes, and dimensions, in Old Japan (excluding Hokkaido) the rice fields averaging perhaps one tenth to one eighth of an acre in size, the more rectangular unirrigated upland fields being somewhat larger, but three quarters of them including less than one-quarter acre.[39] Thus a representative Japanese farmer living in a town, and cultivating two and one-half acres of land, part of it rented, may have this area subdivided into several (usually under 6) noncontiguous plots, and these further subdivided into fields so that the entire farm will be composed of 10-20 individual fields of varying sizes and shapes. He is fortunate if in addition to possessing rice land on the wet lowlands he has other fields satisfactory for dry crops on adjacent elevated sites—beach ridges, levees, diluvial terraces, or mountain foothills. Along with the very obvious disadvantages of the open-field system there is one advantage, viz,; it permits of a somewhat

[39] *Japan at the Beginning of the 20th Century, Tokyo,* 1904, p. 98.

more equitable distribution among farmers of the good and inferior lands as well as those adapted to only one kind of crop. Thus a farmer prefers to cultivate upland plots where he can produce dry crops, fuel, grass, etc., as well as low alluvial rice land.

Over considerable areas of paddy land (amounting to one-fifth to one-fourth the total area in rice) and upland as well, the landscape differs in significant respects from that previously described, most markedly in the larger and more uniform size, as well as in the rectangularity, of the fields.[40] Where this more regular culture-pattern prevails, it usually indicates an "adjustment" of farm lands under government supervision, by which arrangement a farmer is given the equivalent area in one or two contiguous plots, of the combined area of his previously scattered patches. Paths, roads, irrigation and drainage ditches are all rearranged. By this process of "adjustment" a number of advantages are to be gained. (1) Owing to the increased size of the fields (at least to one fourth of an acre) and their rectangularity, farm work is expedited and animal labor and tools can be more easily utilized. (2) Owing to the field boundaries or dikes being straightened and many useless ones destroyed, the productive power of a given area thus treated is increased on the average from 3-5 per cent. (3) The reconstruction of the canal system allows for greater perfection in both irrigation and drainage, thus increasing the land's productivity for rice by insuring to a greater degree against an excess or deficiency of water. In addition, lands which prior to adjustment were too wet for winter crops, can afterwards often be sufficiently well drained for fall planting. Official calculation is that adjustment increases the yield by 15 per cent.

Crops and Crop Landscape.—Few countries specialize in one crop to the same degree that Japan does in rice, that cereal occupying 54 per cent of the total cultivated land. This emphasis reflects not only the high per unit area yield (highest of the "small grains") of rice, its excellent keeping qualities and almost universal use as a food in Japan,[41] but also a very satisfactory physical set-up in terms of a wet subtropical climate,

[40] *The Japan Year Book*, 1926, p. 444.

[41] Large amounts are also used in the manufacture of sake, the national alcoholic liquor.

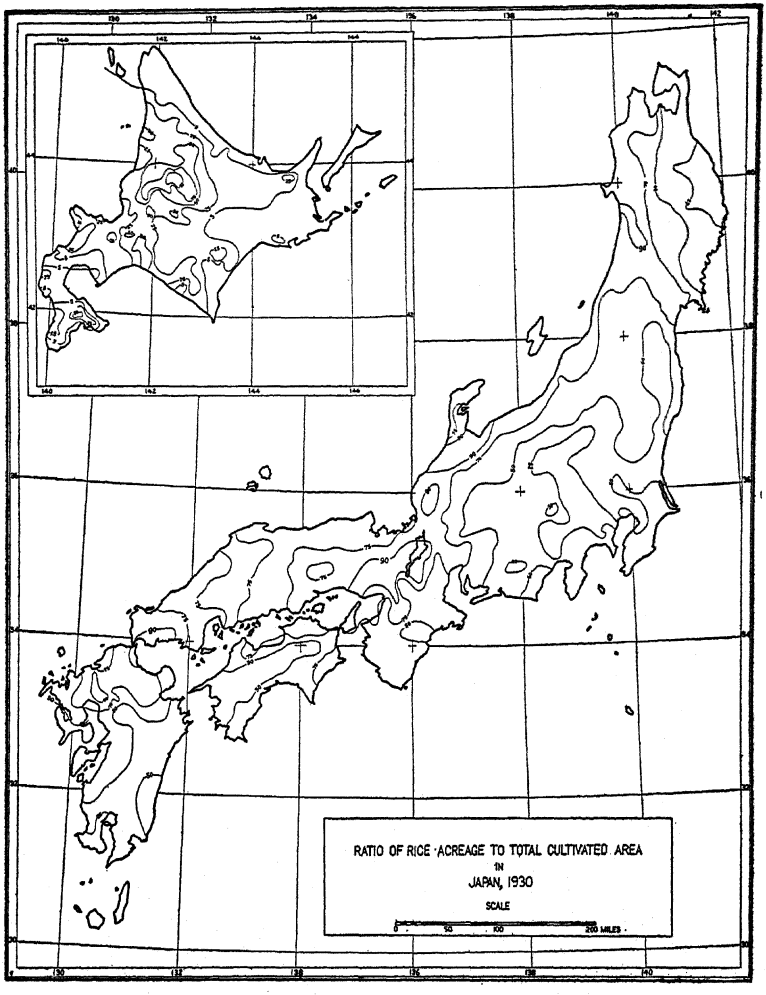


FIG. 11.—Rice is relatively least important in cool northern and eastern Hokkaido and in northeastern Honshu. It is entirely absent in parts of the northern island. The greatest relative importance of rice is on the poorly drained plains of northwestern Honshu. If one subtracts the percentages here shown for rice from 100 per cent, the remainders represent percentages for dry crop acreages. It then becomes a map of dry crop distribution.

and aggradational lowlands which are easily irrigated. Only in cooler Hokkaido, among the larger areas of Japan, does rice cease to be of first importance, although already in northern Honshu are grown shorter-maturing varieties which produce not only less per unit area, but a somewhat lower quality of grain as well. There is a relatively high degree of coincidence between irrigated rice and the low gently sloping alluvial

TABLE 6
Comparative Data on Rice for Aomori Prefecture in Northern Honshu and Fukuoka Prefecture in Northern Kyushu

Prefecture	Quantity hectoliters	Value yen	Area hectares	Ratio of Value: Area	Ratio of Quantity: Area
Aomori	2,354,880	21,977,004	68,543	321	34
Fukuoka	4,446,946	43,469,371	110,576	393	42

plains.[42] Some rice is grown on the smooth but sloping depositional surfaces of diluvial uplands and on the terraced lower slopes of hard-rock hills, but these upland sites are less well adapted to a crop requiring not only irrigation, but months of inundation, and consequently have more often been devoted to dry crops. A large part (65.4 per cent) of the irrigation water for Japan's paddies is obtained from rivers, while reservoirs, often only small ponds, provide 20.9 per cent.[43] Since the plains of Nippon are very restricted in area, irrigation canals are likewise small, so that they are relatively inconspicious and are almost never used for transport purposes as they are in China. On the flattish delta-fans multitudes of diminutive fields, usually irregular in outline, and each enclosed by tiny dikes ten to fifteen inches wide and of equal elevation, form a landscape which is a faceted mosaic in pattern but with rather uniform colorations. At certain locations on some of the plains one can gaze for a mile or more over expanses of paddy fields where there is not an observable variation to mar the monotony, but this is the exception rather than the rule. Interruptions may be in the form of villages, sometimes tree or hedge enclosed, rising like islands above the inundated paddies; elevated footpaths and roads traverse the plains, usually in straight-line courses; intersecting irrigation and drainage canals, or ponds add a note of variation here and there, while in places, scattered dry fields, elevated two feet or more above the paddies and bearing unirrigated crops, stand out conspicuously above the lower story of rice fields. On the sandy and elevated beach ridges which frequently border the sea margins of the delta-plains, as well as on the levee slopes, paddies commonly give way to dry crops. Not infrequently there are riverine belts, where laterally migrating streams have somewhat roughened the surface and

[42] Only 4 per cent of the total area in rice is planted in the unirrigated upland variety.

[43] Dr. P. J. S. Cramer: Notes on Agriculture in Japan Gathered During a Voyage in 1924, *Communications of the General Experiment Station in Agriculture*. No. 22, Dept. of Agric., Industry and Commerce in The Netherlands East-Indies 1926, p. 31.

deposited coarser materials. In such locations unirrigated fields often predominate.

The march of the seasons ushers in a striking succession of landscapes on these delta-plains. Spring witnesses the preparation and sowing of the rice seed-beds which by May or June make themselves conspicuous as they stand out in green patches on what may be prevailingly fallow plains. In early summer, with the transplanting of the young rice seedlings to the paddies, the flooded alluvial lowland becomes a much subdivided water surface pricked by the inconspicuous rice plants. By midsummer the scene has changed and green is the prevailing color over large expanses of the plain, the individual fields still being obvious, however, as they are set off from one another by the interruptions at the dikes. As green changes to yellow in autumn and the ripened grain is harvested, the fields swarm with human beings engaged in cutting and threshing their precious crop, for delay may mean serious losses through damage by wind and flood, for autumn is the season of typhoons. After harvest the plains look shorn and desolate, the only evidence of the recent crop being the bundles of rice straw hung on horizontal poles set up in the stubble-covered swampy paddies. See plates 11, 12, 13.

Probably 60-70 per cent of the paddy area of Japan remains fallow during the winter season, much of it covered with water.[44] This reflects, in part, the inability to adequately drain large areas of the delta-fans so that they are suitable for fall-sown crops, while in northern Honshu and Hokkaido the growing season is too short for double cropping. Besides genge, a pink-blossomed legume, sown broadcast among the ripe grain or the stubble, and used chiefly as green manure, the principal second crops in the paddy fields are wheat, naked barley, barley and rape. If the fields are to be fall planted their surfaces are spaded up into a series of narrow parallel ridges and troughs, the former a foot to eighteen inches wide and perhaps a foot high, and on the ridges grain is sown very thickly in single or double rows. The practice of "ridging" for winter crops is quite essential, for cool-season precipitation tends to keep the paddies relatively wet. It is not uncommon to see water stand-

[44] Daniel H. Buchanan: The Rural Economy of Japan, *Quar. Jour. of Econ.* XXXVII, Aug. 1923, 545-578 (550). See also, Cramer, *op. cit.*, p. 34.

ing several inches deep in the troughs between the rows of grain or rape. Being in rows the fall-sown crops are more easily and effectively cultivated and fertilized. The planted sections of the delta-plains are never more gorgeous than in late spring when the dark green patches of winter grains in rows, are to be seen intermingled with plots of brilliant yellow rape and bright pink genge. See plate 14.

Dry Crops.—Japanese statistical volumes divide the cultivated land of the country into two great classes, (1) rice fields (irrigated land) and (2) upland farms (unirrigated cropped land). But the area in "upland farms," which is less than the irrigated-rice area (46 per cent in upland farms and 54 per cent in paddies), is by no means identical with the sum of the net areas in various dry crops. This discrepancy comes about as a result of, (1) replanting 30 to 40 per cent of the irrigated rice land in winter crops, and (2) multiple cropping (2 to 5 crops from the same plot) by interculture methods on the upland farms. Two crops of rice a year are practically unknown in Japan. With the data available, and not knowing exactly how those data were collected, it is unlikely that an exact computation of the net area in dry crops can be made although I submit the figure, 4,723,000 hectares.[45] This may be compared with the figures, 2,689,000 hectares in upland farms and 3,079,000 hectares in irrigated rice (1930). The common statement that irrigated rice occupies a larger area than all other crops combined is obviously in error.

On a map of Japan showing the distribution of "upland fields" there are two relatively large areas of concentration, Hokkaido and the Kwanto or Tokyo Plain. In both cases this reflects environmental conditions relatively unfavorable for rice culture, a severe climate in Hokkaido, which is less ideal for rice, and a predominance of diluvial upland rather than low new alluvium on the Kwanto Plain.

The small grains, wheat, barley, naked barley and oats, with a combined acreage 48 per cent that of irrigated rice, are grown under three contrasting conditions, involving locational and planting differences; (1) in Hokkaido as spring sown crops almost exclusively; in Old Japan they are fall sown, (2) either

[45] Interculture methods of course cause some duplication.

TABLE 7
Areas in Various Crops*

		Hectares
1. Irrigated rice		3,079,000
2. Dry crops (on upland farms, elevated plots on the plains, and as winter crops in paddy fields)		4,723,000
A. Food crops		
a. Wheat		496,997
Rice fields	227,701	
Upland farms	269,296	
b. Naked barley		471,458
Rice fields	292,970	
Upland farms	178,488	
c. Barley		377,250
Rice fields	105,634	
Upland farms	271,616	
d. Oats		118,087
Rice fields	807	
Upland farms	117,280	
e. Soy beans		346,749
f. Sweet potatoes		259,481
g. Azuki beans		111,426
h. Potatoes		102,956
i. Millets (foxtail, barnyard, and proso)		136,912
j. Buckwheat		96,342
h. Maize		45,544
i. Upland rice		133,423
B. Fruit		77,086
(Oranges, persimmons, native pears, peaches, plums, grapes, etc.)		
C. Vegetables (excluding those listed under "A" above)		543,900
D. Industrial Crops (rape, peppermint, tobacco, sugar cane, hemp, etc.)		233,506
E. Green manure crops		424,307
Rice fields	396,422	
Upland farms	27,885	
F. Tea		37,773
G. Mulberry		710,093

* Data compiled from Statistical Abstract of the Ministry of Agriculture and Forestry, 1930.

as a second crop in paddy fields, or (3) following legumes, vegetables and other summer crops on upland fields.[46] With the exception of oats, which is almost exclusively confined to Hokkaido, and consequently spring-sown, the fall-sown acreage of the other three grains far exceeds that which is spring sown in the north, about 43 per cent of the winter crop being produced in paddy fields, the remainder in dry locations (diluvial and ash uplands, hard-rock slopes, beach ridges, levee crests and elevated plots among the paddy fields). North of latitude 38° very little small grain is raised as a second crop in the

[46] In the extreme northern part of Honshu these grains are both spring and fall sown.

paddies, while the western part of northern Honshu with its heavy winter snows has few winter crops on either upland fields or in paddies. The small grains are eaten mixed with rice or in the form of bread, pastries, confectionery and malt. Some is fed to livestock. Other than those cereals previously mentioned, millets, unirrigated rice and buckwheat are widely grown. The latter is consumed in the form of a macaroni. Upland rice, considered much inferior to the irrigated product and occupying only 4 per cent as great an area, reaches its greatest importance on the diluvial terraces of the Tokyo Plain and on the ash uplands of South Kyushu. Millet is looked upon as a poor man's food.

Vegetables comprise the principal summer crops of the annual type on the uplands. Interculture, a kind of simultaneous rotation in which alternate rows of two different crops planted at different times are grown together in the same field, is a prevalent practice, so that, including winter grains, two to four harvests per year are obtained from a dry field. Such an intensive utilization of the relatively poor, leached, upland soils can be maintained only by frequent and abundant applications of fertilizer, usually not to the whole soil, but fed by hand, often in liquid form, directly along the rows of growing plants. Only in the paddy fields is fertilizer broadcast. Because of their multiple uses (vegetable, soy sauce, fertilizer, confectionery, and others) beans of various kinds are the most universally grown summer crop on the uplands. Early in the spring they are often sown between the rows of winter grain. Daikon, the giant white radish, is also common throughout Japan. Sweet potato and white potato are somewhat complementary in their regional distribution, the former being outstanding in sub-tropical southwestern Nippon, especially Kwanto and Kyushu, with the latter reaching its maximum development in the north, more particularly in Hokkaido.[47]

The total fruit acreage of Japan is only two thirds that of the state of Michigan. Oranges, largely mandarins, are the most important single crop, its value being one third that of all fruit. The groves characteristically occupy hard-rock or diluvial

[47] Dot maps showing distribution of various crops and farm animals are to be found in: (1) Agricultural Atlas of Japan (in Japanese) published by the Imperial Agric. Asso., 1928 and (2) The Modern Atlas of Japan (in Japanese), Tokyo, 1932.

slopes on the Pacific side of sub-tropical Japan south of latitude 36°. Persimmons and native pears, ranking second and third in value are common to all parts of Japan south of parallel 39° or 40°, the latter tree occupying typical paddy sites, its limbs and fruit supported on horizontal wooden trellises. In contrast to the three fruits just mentioned, apples are a specialized

FIG. 12.—Mulberry is absent in most of Hokkaido and is relatively unimportant in Honshu north of parallel 39° or 40°. It reaches its greatest importance in Central Honshu.

crop of extreme northern Honshu and Hokkaido, but are unimportant in the warmer latitudes.

Tea, because it is such a universal drink among the Japanese, is frequently overrated as a crop. Actually the small tea gardens of Nippon occupy less than 0.8 of one per cent of the total net area in dry crops. Their characteristic locations are the diluvial uplands and steep hill slopes of sub-tropical Japan south of latitude 37° although a considerable amount is grown in individual patches around the farm dwellings in villages. About 40 per cent of the country's acreage is in Shizuoka Prefecture along the Pacific coast between Tokyo and Nagoya.[48] Three or possibly four, pickings are obtained. The product is nearly all green tea which finds its principal export market in the United States, Russia and Canada.

Mulberry, the exclusive food for silk worms, is by all odds the principal commercial crop, occupying between 25 and 26 per cent of the upland-farm area. This reflects of course the remarkable importance of silk (raw silk and silk tissues) which in normal years comprises 40 to 45 per cent of the country's exports.[49] Mulberry is grown in all parts of the country although north of parallel 39° or 40° it is unimportant due to climatic handicaps and a sparser population. Within sub-tropical Japan there is a very marked concentration of mulberry and all other phases of the silk industry in Central Honshu. Four specialized regions are to be noted: (1) the valleys and graben basins of Fossa Magna; (2) the fault basins of southern Ou; (3) western Kwanto or Tokyo Plain, and (4) the lowlands and slopes bordering Ise Bay. In parts of these districts sericulture is no longer just an adjunct of general farming, but is itself the chief interest. Mulberry does not require irrigation and is soil tolerant so that it is primarily an upland crop. The most extensive and contiguous areas are found on, (1) hard-rock foothills, and (2) diluvial terraces, ash plateaus and steep, coarse-soiled alluvial and diluvial fans. Other common, although less extensive dry sites than those just mentioned are: (1) the sandy beach ridges along the sea margins of the delta plains,

[48] For a more detailed discussion of the tea landscapes see: Glenn T. Trewartha: The Tea Crop, *Jour. of Geog.*, XXVIII, Jan. 1921, pp. 1-25 (19-24).
Glenn T. Trewartha: A Geograpnic Study of Shizuoka Perfecture, Japan, *Annals of the Asso. of Amer. Geographers*, XVII, No. 3, Sept. 1928, pp. 127-259 (202-209).

[49] Since 1929 the figure has been closer to 30 per cent.

and (2) the river levees. In some plains it is grown on artificially elevated patches among the rice fields.[50]

Animal Industries.—In spite of her abundance of rough land unfit for cultivation, Japan is conspicuously undeveloped in animal industries. The absence of herds and flocks grazing upon the mountain slopes strikes one as an anomaly in economical Nippon. The reasons advanced by the Japanese for their neglect of animal industries include the following:[51] (1) the lack of good natural pasture land, the native wild grass being harsh, coarse and unnutritious and extremely difficult to eradicate; (2) the long, hot, humid summers which make sheep raising and dairying difficult; (3) the absentee ownership of much of the mountain country by capitalists who are loath to permit its utilization except for such a fee as would make animal raising unprofitable; (4) the limited market for animal products in Nippon, the Japanese, never having acquired a liking for dairy products while most of them are unable to afford meat.

Cattle, as well as horses, are chiefly raised for draft purposes,[52] but their regions of specialized production and use are rather complementary, the former being concentrated in sub-tropical Japan south and west of Tokyo, while horses are the chief work animals north of Tokyo and in the island of Kyushu. The cattle are brindle and black beasts, native to Japan. Even in regions of greatest cattle concentration, such as Chugoku Peninsula in extreme southwestern Honshu, where some are raised for slaughtering, the density is only one animal for each two or three farm families, as compared with one animal for four or five farm families, taking the country as a whole. Most of the cattle are not pastured but are kept and fed at the rural residence. Out of approximately 1,512,352 cattle for all Japan in 1931, only 78,235 were classified as milk cows, while 292,122 were slaughtered. Dairying is very meagerly developed, only cooler Hokkaido with its better grasses, and having 40 per cent of all the country's milk cows, producing butter and condensed milk in commercially exportable quantities. In sub-tropical Japan

[50] For a more detailed account of the silk industry, especially as it has been developed in the mountains of Central Honshu see, Glenn T. Trewartha: The Suwa Basin: A Specialized Sericulture District in the Japanese Alps, *Geog. Rev.* XX, No. 2, April 1930, pp. 224-244.

[51] See Trewartha: A Geographic Study of Shizuoka Prefecture, *op. cit.*, pp. 146-147 including footnotes.

[52] Seventy-seven per cent of Japan's cattle are draft animals.

what few milk cattle there are, are concentrated in the vicinity of cities where their product is consumed almost exclusively in fluid form.[53] Swine, kept as scavenger animals at the farmstead, are only half as numerous as either cattle or horses, while sheep are rare. Poultry raising is an adjunct of general farming, the value of eggs produced in 1931 being greater than that of meat.[54]

Such intensive cropping as is practiced by the farmers of Nippon requires frequent and abundant application of fertilizer. The small number of farm animals precludes barn-yard manure from being of much importance. Other than commercial fertilizer, human excrement and green manure are of chief significance. One of the common morning sights in any Japanese city are the very numerous low four-wheeled ox- or horse-drawn wagons loaded with wooden tubs filled with night-soil, moving out toward the rural areas. Green manures are either plowed under, as is usually the case with legumes, or in the form of weeds, grass, and leaves, are spread over the field as a mulch. Commercial animal manures are principally either fish-waste or the chrysalises of silkworms. Those of vegetable origin are largely oil cake (bean, rape or cotton), bean cake ranking seventh in value among Japan's imports. Commercial mineral fertilizers, however, far exceed those of other origins.

B. FISHING.—Among the nations Japan has no near competitor in the fishing industry, her annual catch being three to four times that of either the United States or Great Britain. In Nippon, inexpensive seafood as a substitute for meat, is a common article of diet. Of 1,482,403 persons engaged in fishing (1931), nearly one-half were farmers, shop-keepers and others who made it only a part-time and auxiliary industry. Only 12 per cent of the 360,690 fishing vessels were equipped with motors. Where they depend upon man power, skulling is more usual than rowing. The small, crude, picturesque sailers

[53] Per capita consumption is only .6 gal.

[54] The principal sources of reliable agricultural data for Japan are:

1. The Statistical Abstract of the Ministry of Agriculture and Forestry (in English) published by the Ministry of Agriculture and Forestry, Japan. Data are only for the country as a whole and not for smaller political units. It is an abstract of data included in the following volume (2).
2. The Seventh Statistical Volume of the Ministry of Agriculture and Forestry; (in Japanese) published by the Ministry of Agriculture and Forestry, Japan, 1932. Contains data for the prefectures as well as for the country as a whole.
3. The Report of the Agricultural Investigation, 1929; (in Japanese) published by the Cabinet Statistical Bureau, Japan. Contains data not only for the prefectures but for "gun" and villages as well.

commonly have junk rig and not infrequently matting sails. This marked emphasis upon fishing in Japan reflects, (1) the dense population in conjunction with the meager resources for food production within the country; (2) its insular character and tremendous length of coastline; (3) the peripheral concentration of the population, and (4) the excellent fishing grounds in the vicinity of the islands, where converging warm and cold currents contain a great variety of marine life, and likewise along the Siberian coast.

Regional specialization should not be emphasized too strongly for the entire coast-line from northern Hokkaido to southern Kyushu is thickly dotted with fishing ports of various degrees of importance. Not only are the local waters fished, but likewise those bordering the Siberian coast. As a general rule, those coasts which are most deeply indented and at the same time are backed by rugged unproductive hinterlands, show the most intensive development of the industry. One is very conscious in Japan of landscape features associated with the fishing industry. "Strassendorf" beach-ridge fishing villages, often dilapidated in appearance, their strands cluttered with boats, nets and drying fish and seaweed, are typical cultural elements of the littoral. The coastal waters for miles off-shore are dotted with small vessels; forests of masts seem to fill the little harbors. Within villages and cities fish markets are conspicuously numerous and excellent fresh sea-food is always available in native inns.

Twenty-four varieties of fish, and the catch of each, are listed in the Statistical Abstract, the six most important in order of rank being: sardines, red sea-bream, yellow tail, herring, tunny, and mackerel. Of these herring, sardines and cod are obtained chiefly in northern waters by Hokkaido fishermen, herring almost exclusively so. Seaweed, used as an article of food as well as in the manufacture of iodine, valued at 8,000,000 yen, was recovered in 1931, while aquacultural products (carp, eel, oysters, trout, goldfish and others) amounted to 19,129,000 yen. Fish are not only consumed fresh, but tremendous quantities are dried, salted and canned, as well as converted into fertilizer.[55] Floating as well as shore canneries specialize in crab and salmon, 90 per cent of the former and 70 per cent

[55] Total value of prepared fishery products in 1931 amounted to 137,378,712 yen.

of the latter product going abroad to European and American markets.

c. MINING (including waterpower).[56]—For a first-class nation Japan is meagerly supplied with the basic minerals for manufacture. Among the great variety of minerals extracted, only two, coal and copper (63 and 14 per cent respectively, of the value of mineral output in 1931) are produced in significant quantities.

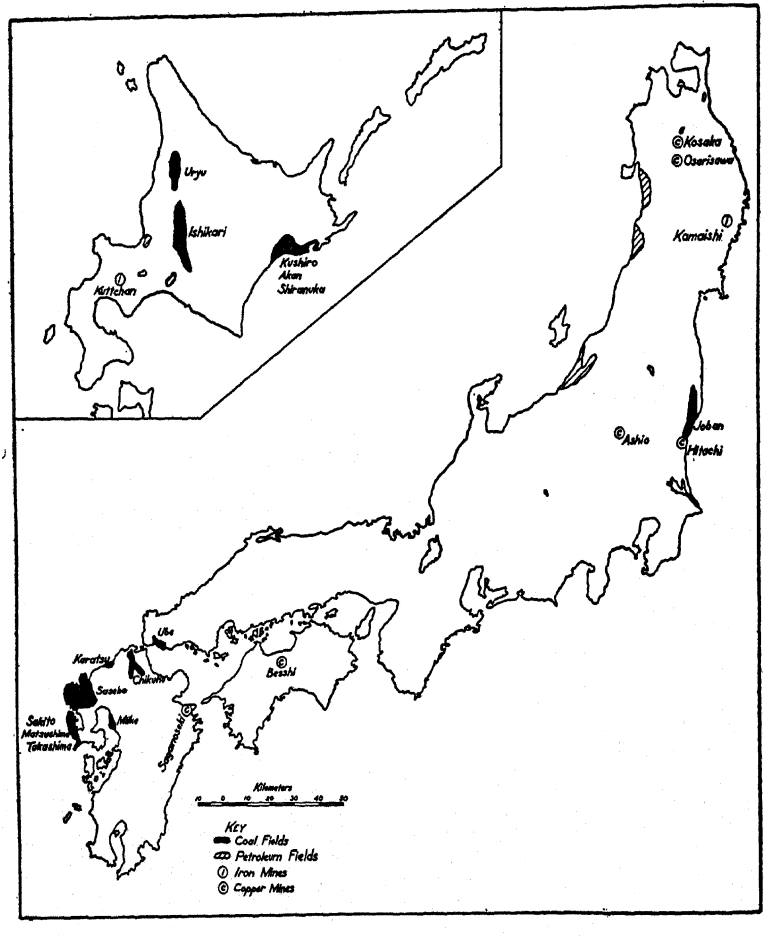


Fig. 13

[56] Excellent summary in J. Foster Bain: *Ores and Industry of the Far East* (revised edition), New York, 1933.

Coal.—Of this most fundamental of the power minerals Japan is estimated to have a total probable reserve of 8,276,000,000 tons and an actual proven reserve of less than 1,000,000,000 tons.[57] Her per capita reserve of 127 tons is far below that of the leading industrial nations (United States 27,500, United Kingdom 4,070, Germany 3,920). With an annual production of approximately 30,000,000 tons[58] the probable reserve will last for some time but as long as production remains where it is, Japan can scarcely be a manufactural nation of first rank, at least not in the heavy industries. On the other hand if industrialization and the consumption of power proceed to the degree to which they have in some western nations, the supply of coal will be exhausted within a few decades and long before there is a serious coal shortage the increased costs of mining thinner seams at greater depths will adversely affect industry.

The coal mined is only of fair quality, 90 per cent of it being low grade bituminous or black lignite, containing excessive amounts of impurities and volatile matter. Only very meager amounts are even of fair coking quality, most of it being too soft to support the load in a blast furnace and therefore requiring additions of good Chinese coking coal.

The two principal deposits are in Hokkaido and in northern Kyushu, the former with 37 per cent of the reserves and the latter with 32 per cent. In production however, their positions are reversed for during the period 1913-1927 the North Kyushu fields produced 66 per cent of the country's output as compared with 14 per cent for Hokkaido. This discrepancy reflects the closer proximity of northern Kyushu to centers of population, industry and main shipping routes. The remaining 20 per cent of the country's coal output is from a number of small deposits, principally the Joban field along the Pacific coast about 120 miles north of Tokyo, and the Ube field on the south coast of Chugoku Peninsula some 25 to 30 miles east of Shimonoseki.

Petroleum.—The total known reserves of this mineral are extremely meager while annual production, including that of Taiwan, amounts to only 1,630,000 barrels (1932), or less

[57] Kyukichi Watanabe: Coal Resources of Japan, *Conference Proof No. 15 of World Power Conference*, Sectional Meeting, Tokyo 1929, Appendix II.
[58] 452,000,000 metric tons produced in period 1913-1927.

than the normal daily production in the United States. The petroleum belt extends from central Hokkaido along the Japan-Sea coast of Honshu to about latitude 37. Nearly 90 per cent of the oil comes from the Akita and Niigata fields along the west coast of northern Honshu.

Waterpower.—Considering the area of the country, high relief and abundant precipitation have combined to provide Japan with relatively bountiful waterpower resources (6,000,000 H.P.), over one half of which has been brought into use. With 3,500,000 H.P. developed in 1931, Japan ranked fourth among the nations, after the United States, Canada and Italy.[59] The greatest concentration of both potential and developed water power, especially of large hydro-electric plants, is in the broad mountainous region of Central Honshu where there are some of the largest streams of the country, and along whose Pacific margins, coinciding with Kwanto and Nobi Plains, are great population clusters and important industrial cities. Very typical of Japan as a whole, as a consequence of the many small but numerous rivers, are the large number of small generating plants, sometimes ten or twelve along a single stream.

Consumption of hydroelectric power is confined chiefly to industry (textiles, machine, chemical, mining, and foodstuffs), urban transportation, and lighting in homes. The use of electricity for home illumination is almost universal, even throughout the rural districts. In contrast to the situation in the United States, hydro-generation of electric power in Japan is much more important than steam generation, reflecting the higher price of coal and its less efficient use in Nippon. The unexploited reserve of waterpower is not large enough however, to materially offset the deficiency in coal so that meagerness of power resources is likely to be an inhibiting factor in Japanese industrial expansion.[60]

Iron Ore.—With a reserve of only 40,000,000 metric tons of iron ore (the annual consumption in the United States is 30,000,000 to 75,000,000 tons) utilizable under existing metallurgical processes, within the borders of Japan Proper, Nippon

[59] *Commerce Year Book 1931*, U. S. Dept. of Commerce, Vol. II, p. 702.

[60] Orchard (*op. cit.*) estimates that if there were developed all the hydro-electric power which can be depended upon all year, the power supply now being derived from both coal and waterpower would be increased only 45-60 per cent. p. 269.

is woefully deficient in another basic mineral raw material. There are probably 40,000,000 additional tons of low grade magnetite not at present profitable to work, and several billion tons of iron-sand containing 30 per cent iron but at present impossible to use economically because of its low grade and high titanium content.[61] The practical possibilities of these iron sands, commonly found in marine terraces, still remain a problem. Most of the Japanese ore deposits are of small size, composed of badly mixed grades, located in hilly and mountainous regions and subject to high transportation costs. Domestic production in 1931 was only 208,181 tons, or about 11 per cent of the total consumed, the imports arriving chiefly from the Straits Settlements, Central China, Chosen and Australia. Only two regions in Japan are producing iron ore in any quantity: (1) the Kamaishi mine in the Kitakami hill lands (Iwate prefecture of northeastern Honshu) where in 1931, 103,857 tons of 55-65 per cent magnetite were mined, and (2) the Kutchan mine in western Hokkaido which produced 91,250 tons of 45-50 per cent limonite. At the Abuta mine, also in Hokkaido, and only recently reopened, 13,074 tons of 55 per cent ore were extracted in 1931. The workable reserves at Kamaishi and Kutchan are 14,000,000 tons and 6,000,000 tone respectively. [62] Smelting plants are located in the general vicinity of each ore body (except Abuta) but not immediately on the field.

Copper.—Next to coal, copper is Japan's principal mineral, although it amounts to only 8 per cent (1932) of the total world production. There are scores of mines spread widely over the country although five large and far separated mines produce most of the ore.

D. MANUFACTURING.[63]—Contrary to general impression throughout the Occident, Japan measured by American and European standards, is not a highly industrial nation. Of the leading countries only Italy and Russia are so completely de-

[61] Economic and Trade Notes No. 232, U. S. Dept. of Commerce, 1931. See also Trade Inf. Bull., No. 573, U. S. Dept. of Commerce.

[62] *Ibid.*

[63] Japanese industry staged a marked revival in 1932 and 1933 as compared with what it was in 1931, and this in spite of serious losses in the Chinese market. The index of Japanese industrial production in 1932 was 108, based upon 1928 production as 100. This revival is largely the result of increased export made possible by the systematic depreciation of the yen which allowed Japan to outsell her competitors in the world markets. See, G. C. Allen: Japan's Position and Prospect, *Geography*, No. 104, Vol. XIX, Part 2, June, 1934, pp. 87-95.

pendent upon the land. In 1928 only 2,144,000 persons were employed in factories having more than five workers. Prior to 1870, Japan had not a single mile of railroad and only feudal means of overland transport prevailed. Heavy goods could be moved long distances only by water, hence industrial development was in general restricted to coastal towns, and in a large measure this situation is true even today.

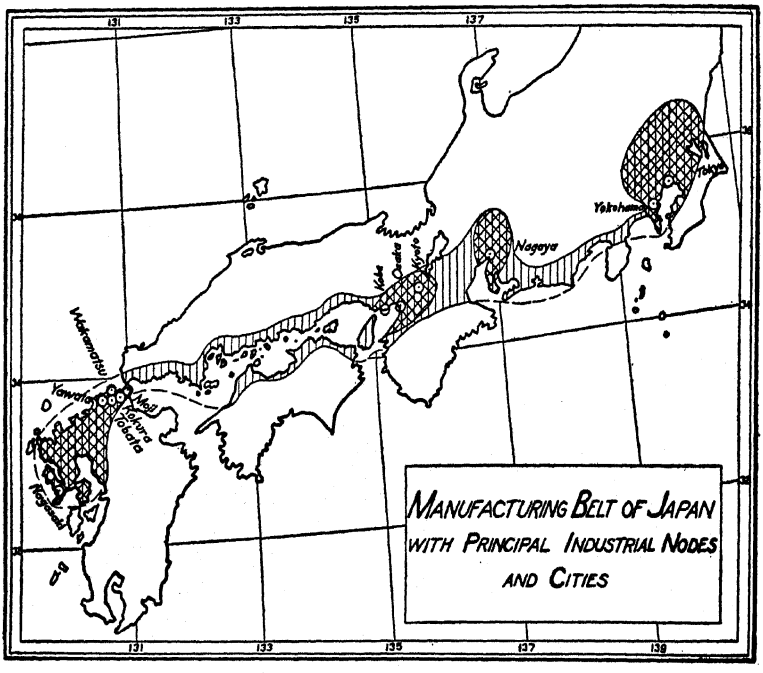


FIG. 14.—This map does not include the specialized silk reeling area located in Central Honshu.

A distinguishing and characteristic feature of Japanese manufacturing is the small size of the industrial plants. The inconspicuous workshop, not the prominent factory, is the dominant unit. It has been estimated that over half of the workers in industry are employed in establishments having fewer than 5 workers,[64] while more than 50 per cent of the 56,000 factories with 5 or more employees have only 5 to 9 workmen.[65] In only two industries, cotton spinning and metal refining and

[64] Orchard, *op. cit.*, p. 185.
[65] Moulton: Japan, *op. cit.*, p. 132.

processing has the factory become the common unit of production.

Certain it is that Japan is inherently handicaped in the development of extensive manufacturing industries, particularly the heavy industries. Power is not abundant and raw materials, with the exception of silk, are definitely meager. While these are not insuperable obstacles, they are nevertheless serious retarding influences and without doubt have been one reason for a partially government-owned and government-fostered industrialism.[66] Abundant cheap labor would seem to be the chief industrial asset of Japan and yet Dorothy Orchard is authority for the statement, ". . . in Japan, labor for manufacturing industries has been neither abundant nor especially cheap."[67] Its inefficiency partially offsets its cheapness.

The principal manufactural belt of Nippon, nearly 800 miles long and somewhat broken or attenuated in places, extends along the Pacific coast from Tokyo on the north through Tokai, Kinki, and the Inland Sea region to Nagasaki in northwestern Kyushu. It is coincident with the belt of highest population density previously described. On its northern margin it makes juncture with a secondary industrial area specialized in silk reeling, which includes besides the Kwanto and Nobi Plains which are within the general industrial belt, the mountainous prefectures to the west and north of Kwanto. In this relatively inaccessible mountainous core of Central Honshu, which produces over one-half of Japan's raw silk, more than 65 per cent of the industrial workers are employed in filatures. This specialization is associated with, (1) the earlier isolation and inaccessibility of the region which placed a premium upon a light, compact and extremely valuable commodity, as well as (2) the relative predominance of inferior slope land which is fairly satisfactory for the tolerant mulberry crop. Mountain rivers provide the small amount of required power, in the form of electricity, necessary to operate the reeling plants, which are housed in small, inconspicuous, flimsily-constructed buildings.[68]

The principal industrial zone, lying between Tokyo and Nagasaki as poles, overshadows the specialized silk region in

[66] *Ibid.*, Chaps. XVII and XVIII.
[67] Orchard, *op. cit.*, p. 340.
[68] See Trewartha: The Suwa Basin, *op. cit.*

importance. On the whole its particular advantages for manufacturing are not so striking; only its southern extremity lies adjacent to a coal field. It is, to be sure, the old, long occupied, most urbanized part of Nippon, with some of the largest bay-head plains and coincident with them the country's largest clusters of population.[69] Moreover along the quiet waters of the Pacific-coast bays and the Inland Sea, adjacent to the principal ocean routes, have developed the most significant port cities, through which enter foodstuffs and the raw materials for manufacture. The region's single greatest advantage without doubt is accessibility to tide-water. Within the general industrial belt four nodes can be recognized. (1) First in importance is the *Osaka-Kobe-Kyoto* center at the eastern end of the Inland Sea (Kinki region), Osaka being the greatest industrial city in Japan as well as the third foreign-trade port, while Kobe is the country's first port. Diversity in manufactures is characteristic, with textiles, especially cotton spinning and weaving, standing out above all others, and fabricated iron and steel products next. Kobe has fame particularly through its shipbuilding, and Kyoto for its artistic products. (2) Next in rank is the *Tokyo-Yokohama* node, with even greater diversity of products (textiles, fabricated iron and steel, electrical apparatus, ship-building, and others) and less emphatic specialization than in Kinki. Yokohama, Japan's second port, is the gateway for this region, and like Kobe, is a major shipbuilding center. (3) Third in importance is the region around *Nagoya* at the head of Ise Bay, a center specialized in textiles, especially silk spinning, and cotton spinning and weaving. (4) In *northern Kyushu*, adjacent to a principal coal field, is the fourth region of concentration, emphasis here being upon heavy industries such as iron and steel, cement, flour milling, and the like.

In relative importance (based upon value of products and number of workers) among the various groups of manufacturing enterprises, textiles occupy a dominant position, with metals a poor second. Among the textiles the reeling, spinning and weaving of silk ranks first, it being the single great industry based primarily upon domestic raw materials.[70] In 1930 there

[69] For a more detailed analysis of the industrial districts see Orchard, *op. cit.*, chapters VIII, IX and X.

[70] Japan produces about 64 per cent of the world's raw silk.

were 3750 filatures and 67,000 households engaged in reeling raw silk. These small and relatively inconspicuous establishments are widely scattered throughout sub-tropical Japan, but, as before stated, with a definite concentration in southern Ou, mountainous Central Honshu, and the adjacent Kwanto and Nobi Plains. Cotton spinning comes next in importance, the number of spindles in Japan being comparable to that in New England and fewer than that in British India. The industry is based entirely upon imported raw material from the United States, China and India, cotton being the country's single largest import, while cheap cotton textiles, sold chiefly in eastern and southern Asia, stand next to raw silk in the country's export list. Large factories are the rule. The principal region of concentration is in Osaka and vicinity, with the Nagoya and Tokyo regions as secondary centers. Unlike the spinning of cotton, the weaving industry is housed in relatively inconspicuous little buildings, many of them no more pretentious than an American farmer's implement shed. Because of its workshop character, weaving is also more widely dispersed than spinning, although the important spinning centers are also noteworthy weaving, bleaching, and dyeing districts. It is in cotton textiles, whose processing requires less power than does the smelting of metals, that Japan is making her chief bid for international industrial fame. In 1932 she was a close second to Great Britain in yardage of cotton cloth exported and in 1933 slightly exceeded her.

If, as has been stated, the steel and iron production of a nation is an index of its general industrial strength, Japan's position is far from strong. The meager 1,156,215 metric tons of pig produced within Japan Proper in 1930 (917,342 tons in 1931) were largely from imported raw materials, 94 per cent of the iron ore and a considerable part of the coking coal being of foreign origin.[71] Within Japan Proper there are four distinct centers of pig iron production: North Kyushu in the vicinity of Yawata, northeastern Honshu at Kamaishi (Iwate Prefecture), southern Hokkaido near Muroran (Wanishi), and Yoko-

[71] For a more complete treatment of the Japanese Iron and Steel Industry see: Trade Information Bulletins Nos. 573, 612 and 615 of the U. S. Dept of Commerce; Orchard, *op. cit.*; Moulton, *op. cit.*; Susumu Hattori: The Iron and Steel Industry of Japan, *Proceedings of the World Engineering Congress*, Tokyo, 1929, Vol. XXXIII, Part I, pp. 43-78 and Shingo Unotoro: The Progress and Present State of Pig Iron Manufacture in Japan, *Ibid.*, pp. 255-279.

The data are from Economic and Trade Notes, No. 232, U. S. Dept. of Commerce, May 21, 1931.

TABLE 8

Sources of Iron Ore, 1930	
Domestic Production	140,000 tons (kilo)
Imported	2,261,387 " "
Pig Iron Production, 1930	
Japan Proper	1,156,215 metric tons
Chosen	150,541 " "
Imports	407,376 " "
Total	1,714,132 " "
Steel Production, 1930	
Japan Proper	1,794,500 metric tons
Imports	436,922 " "

hama. The product from North Kyushu, amounting to 75-80 per cent of the total, is from government owned or operated plants. It has the advantage of being adjacent to the Kyushu coal fields and since it imports all of its ore, as well as considerable coking coal, the tidewater location of the plants is an economy. The region has 8 blast furnaces of over 100 tons capacity out of a total of 15 for the country, and its production of steel is 60+ per cent of the nation's output. At Muroran in Hokkaido there

TABLE 9

Pig Iron Production in Japan

	1928	1931	
North Kyushu (Yawata and Tobata)	838,897	639,470	metric tons
Muroran, Hokkaido	109,543	62,287	" "
Kamaishi, northeastern Honshu	75,737	111,913	" "
Yokohama	54,685	61,490	" "

are 4 blast furnaces of over 100 tons capacity and 2 at Kamaishi. Both are steel producing regions as well. Unlike the North Kyushu region these two smaller centers consume principally local ores. Muroran is not far distant from the Ishikari coal field in Hokkaido, while Kamaishi receives its fuel by boat from the same field. Domestic coal and Chinese ore are used in the Asano plant at Yokohama whose equipment consists of only one blast furnace. Steel plants are somewhat more dispersed than blast furnaces, so that in addition to the pig iron centers, Tokyo, Kobe, Osaka and Nagasaki are also points of concentration although North Kyushu is responsible for nearly 50 per cent of the total output of steel ignots.

4. Communications and Trade

Japan presents remarkable contrasts in the development of its several kinds of communications, for while its highway system is still primitive and inadequate, rail and boat service are modern and efficient. During the rule of the Tokugawa shoguns, when the feudal lords or "daimyos," with their "samurai," were compelled to congregate at the capital, Yedo (Tokyo), at stated intervals, a number of famous highways were developed. Chief among these was the Tokkaido, following the coast between Kinki, where the Emperor was in residence at Kyoto, and Kwanto. Automobiles, except in the cities, are scarce, so that the roads are obliged to carry chiefly slow-moving local traffic, principally bicycles and man and animal-drawn carts. Inter-village auto-bus service is becoming relatively common however, and this innovation is emphasizing the need for the development of a genuine highway system patterned upon modern lines. Because of the heavy rainfall and the wet nature of the plains, roads on the alluvium are usually elevated several feet, and are surfaced, but not smooth. They are commonly so narrow that it is difficult for two cars to pass, and the traffic situation is further aggravated by the numerous villages which flank the roads, their streets filled with pedestrians as well as all kinds of slow moving conveyances. One's patience as well as his nerves are worn thin when traveling by auto-bus over the narrow, rough and crowded highways of Japan.

By contrast the railroad service is excellent. In 1932 there were 24,740 kilometers of railway in Japan of which 14,910 km. were state owned. The government railroads are all narrow gauge (3 ft. 6 in.); the rolling stock is correspondingly light and speeds maintained are less than for the trains of Europe and the United States. The privately owned lines are usually of still narrower gauge and act principally as feeder lines. The railway net is relatively dense, but much less per unit area than for western Europe or even the United States, while the mileage per 1,000 inhabitants is only one eleventh to one twelfth that of the United States and less than one fifth that of France. Nevertheless in such a mountainous country where tunnels are frequent and the construction cost is great, and moreover where population is concentrated along the coasts,

this is a remarkably good showing. The trunk lines in general follow the coasts, avoiding thereby as much as possible mountain grades and at the same time serving the productive delta lowlands. Less frequent service is maintained on those lines crossing the mountainous interior and joining the coasts. Passenger traffic in Japan is extremely heavy, the third class coaches being uncomfortably crowded. Three fifths of the railway's revenue is from passenger fares alone.

River transportation in Japan, largely because of the short, swift and shallow nature of the streams, is negligible. Coastwise shipping on the other hand is extremely important, this form of transport being favored by the numerous natural harbors and the fact that such a large proportion of the population lives so close to the ocean margins. A foreigner is impressed by the number of little craft, sailing as well as steam, which crowd the several hundred small ports. In tonnage of ocean shipping Japan takes third rank[72] among the nations but it is a poor third and contains an unusual number of old ships purchased from foreign nations. Of the 758 trading ports in Japan, 38 are open to foreign ships, and of these only three, Kobe, Yokohama and Osaka, all on the Pacific side, are of first rank. Through these three pass 90 per cent of the nation's foreign trade: Kobe 37 per cent, Yokohama 30.4 and Osaka 21.4. Each of these, but more especially Kobe and Yokohama, serves not only an important local populous hinterland with industrial developments, but is a national entrepôt port as well.

In 1929, the last normal trading year, Japan's foreign trade amounted to nearly 4,365,000,000 yen (2,841,453,000 yen in 1932) with imports exceeding exports by 68,000,000 yen. Incoming cargoes were predominantly raw materials for manufacture (55.3 per cent), with the other classes of commodities ranking in the following order: semi-finished manufactures (16.1 per cent), finished manufactures (15.6 per cent), and foodstuffs (12.2 per cent). One item, raw cotton, amounting to nearly 30 per cent of the total value of all imports, stands out prominently. Among the exports on the other hand, finished manufactures (44.6 per cent) and semi-finished manufactures (42.0) comprise nearly 87 per cent of the outgoing trade. Two

[72] In 1932 Norway, Germany and Japan were approximately equal in merchant marine tonnage.

TABLE 10
Composition of Foreign Trade of Japan Proper, 1929*
(In thousands of yen)

Commodity	Value		Percentage of total
I. Imports			
Cotton	573,016	(296,115)	25.9
Iron and steel	159,721	in 1932	7.2
Machinery	121,094		5.5
Wool	101,815		4.6
Lumber	88,837		4.0
Beans	78,745		3.6
Bean-cake	75,919		3.4
Wheat	70,896		3.2
Sulphate of ammonia	48,086		2.2
Coal	42,978		1.9
Mineral oil	38,770		1.8
Sugar	31,159		1.4
Rice and paddy	22,781		1.0
Woolen tissues	19,941		0.9
Woolen yarn	18,736		0.8
Miscellaneous	723,746		32.6
Total	2,216,240		100.0
II. Exports			
Raw silk	781,040	(355,393)	36.3
Cotton tissues	412,706	in 1932	19.2
Silk tissues	149,954		7.0
Porcelain and eathenwares	36,962		1.7
Cotton hosiery	36,711		1.7
Refined sugar	29,974		1.4
Marine products	26,998		1.3
Cotton yarn	26,755		1.2
Paper	26,288		1.2
Tinned foodstuffs	25,680		1.2
Coal	23,215		1.1
Lumber	21,138		1.0
Iron manufactures	15,195		0.7
Glass and glasswares	13,210		0.6
Tea	12,028		0.6
Miscellaneous	510,764		23.8
Total	2,148,618		100.0

*Moulton, *op. cit.*, p. 598.

textile products, (1) raw silk and silk tissues (43 per cent) and (2) cotton yarns, fabrics and clothes (22 per cent), together account for over 65 per cent of the total export.

Japan's foreign trade moves in two great streams of almost equal importance, one connecting with the United States, the other with eastern and southern Asia. The former market absorbs chiefly luxuries, raw silk amounting to nearly 85 per cent of the exports to the United States, pottery and tea being the

other most important items. On the return voyage cargo consists of such items as raw cotton, wood, automobiles and iron and steel. To the Asiatic market on the other hand go prin-

TABLE 11

Analysis of Japan's Trade: Origins and Destinations (thousand of yen)

	Imports		Exports		Total		Per cent	
	1929	1932	1929	1932	1929	1932	1929	1932
1. The United States	654,060	509,874	914,084	445,147	1,568,144	955,021	36	34
2. Asia	857,953	450,911	915,232	677,613	1,773,185	1,128,524	41	40
a. China	209,975	102,746	346,652	141,177				
b. British India	288,119	116,865	198,056	192,492				
c. Kwantung	166,322	76,719	124,476	120,584				
d. Dutch East Indies	77,345	40,409	87,125	100,251				
e. Hongkong	607	977	61,065	18,141				
3. Europe	419,842	225,261	147,248	125,748	567,090	351,009	13	12

cipally staple manufactured wares, more especially cotton textiles (40 per cent), sugar, coal, aquatic products and paper.

It becomes evident from the preceding table that, after that of the United States, the Chinese market (including Kwantung and Hongkong) has been of outstanding significance to Japan. The marked decline in trade with China since 1930-1931 is the result of Chinese boycotts brought on by the Manchurian and Shanghai clashes. In 1928 China took 44.2 per cent of Nippon's exported cotton cloth; in 1932 only 9.5 per cent. At least one reason for Japan's aggressive campaign for new foreign markets during 1932 and 1933 has been this serious decline of a primary textile market. The success of this campaign is indicated by an increase of 23 per cent in the value of the nation's exports between 1931 and 1932. A greatly depreciated currency, without doubt, gives Japan an effective weapon in this competition for world markets. It is in textiles and light manufactures in general, rather than in heavy metal products, that Japan can hope to compete with western nations.

PART II

REGIONAL SUBDIVISIONS OF JAPAN

B. OU

Region 1. Eastern Highlands
- 1a. Kitakami Hill and Mountain Land
- 1b. Abukuma Hill Land
  - 1b[1]. Coastal Belt

Region 2. Eastern Lowlands
- 2a. Mutsu (Sambongi) Diluvial Plain
- 2b. Kitakami Lowland
- 2c. Abukuma Lowland
  - 2c[1]. Fukushima Basin
  - 2c[2]. Koriyama Basin

Region 3. Central Mountain Range

Region 4. Western Intermontane Basins
- 4a. Aomori Plain
- 4b. Hanawa Basin
- 4c. Odate Basin
- 4d. Yokote Basin
- 4e. Shinjo Basin
- 4f. Yamagata Basin
- 4g. Yonezawa Basin
- 4h. Wakamatsu Basin
- 4i. Inawashiro Basin

Region 5. Western Range of Mountains and Hill Country
- 5a. Tsugaru Horst
- 5b. Dewa Hills
- 5c. Asaki-Iitoyo Mountains
- 5d. Echigo Hills and Associated Grabens

Region 6. Western Plains of Ou
- 6a. Tsugaru Basin
- 6b. Noshiro-Omono Plain
- 6c. Shonai or Mogami Plain
- 6d. Echigo or Niigata Plain
- 6e. Takata Plain

C. CHUBU

Region 1. Central Mountain Knot
- 1a. Transverse Tectonic Depression or Fossa Magna
  - 1a[1]. Hill and Mountain Masses of Fossa Magna
    - (1) Izu Peninsula
    - (2) Mt. Fuji
    - (3) Tertiary Mountains
    - (4) Yatsu Volcanic Group
    - (5) Myoko Volcanic Group
    - (6) Northern Tertiary Hills
  - 1a[2]. Fault Basins of Fossa Magna
    - (1) Matsumoto Basin
    - (2) Suwa Basin
    - (3) Kofu Basin
    - (4) Nagano Basin
    - (5) Ueda Basin
- 1b. Highlands East of Fossa Magna
  - 1b[1]. Nasu Volcanic Chain
  - 1b[2]. Chichibu Mountains
  - 1b[3]. Ashio Mountains
  - 1b[4]. Boso Peninsula
  - 1b[5]. Miura Peninsula
- 1c. Highlands West of Fossa Magna
  - 1c[1]. Hida Highlands
  - 1c[2]. Tertiary Hill Country
  - 1c[3]. Kiso Mountains
    - (1) Ina Trench
  - 1c[4]. Akaishi Sphenoid

Region 2. Lowlands of the Hokuroku (Japan Sea) Littoral of Chubu
- 2a. Toyama Alluvial Piedmont
- 2b. Plains west of Noto Peninsula

Region 3. Lowlands of the Tokai (Pacific) Coast of Chubu
- 3a. Kwanto or Tokyo Plain
- 3b. Sun-en Coast
- 3c. Nobi or Nagoya Plain and Associated Lowlands Bordering Ise Bay

D. INNER ZONE OF SOUTHWEST JAPAN

Region 1. Kinki or Eastern Setouchi
- 1a. Hilly Uplands
  - $1a^1$. Omi-Iga
  - $1a^2$. Ikoma
  - $1a^3$. Izumi
- 1b. Fault Basins
  - $1b^1$. Biwa (Omi) Basin
  - $1b^2$. Yamato or Nara Basin
  - $1b^3$. Kyoto (Yamashiro) Basin
  - $1b^4$. Osaka or Settsu Plain
  - $1b^5$. Kino Graben

Region 2. Central Setouchi (Inland Sea)
- 2a. The Islands
- 2b. Sanyo District
  - $2b^1$. Interior Hill Lands of Southern Chugoku
    - (1) Tamba "Plateau"
    - (2) Kibi "Plateau"
    - (3) Western Chugoku
  - $2b^2$. Coastal Margins of Southern Chugoku
- 2c. Inland Sea Margins of Shikoku
  - $2c^1$. Yoshino Rift Valley
  - $2c^2$. Matsuyama Plain

Region 3. Sanin Littoral of Northern Chugoku

Region 4. Northern Kyushu
- 4a. Tsukushi Hill Lands and Associated Plains
  - $4a^1$. Seburu Horst
  - $4a^2$. Chikuho Block "Mountains"
  - $4a^3$. Coastal Margins
  - $4a^4$. Tsukushi Plain
  - $4a^5$. Miiki District
- 4b. Northern Volcanic Region
  - $4b^1$. The Lava Plateau
  - $4b^2$. Mt. Aso
- 4c. Insular and Peninsular Northwestern Kyushu
  - $4c^1$. North Hizen
  - $4c^2$. The Peninsulas
  - $4c^3$. Amakusa Islands

E. PACIFIC FOLDED MOUNTAINS OR THE OUTER ZONE OF SOUTHWEST JAPAN

Region 1. Southern Kyushu
- 1a. Kyushu Folded Mountains
  - $1a^1$. Hitoyoshi Tectonic Basin
  - $1a^2$. Sadowara Coastal Plain
- 1b. Southern Ash Upland and Associated Steptoes
  - $1b^1$. Miyakonojo Basin

Region 2. Southern Shikoku
- 2a. Kochi Plain

Region 3. Kii Peninsula

A. HOKKAIDO

In at least one landscape element, the general predominance of hill country and mountain, Hokkaido very much resembles the remainder of the country; in most other characteristics there are genuine differences or at least modifications. As in Old Japan, regions of low elevation are aggradational in origin, the Ishikari-Yufutsu Plain in the west being chiefly alluvium, while the southeastern lowlands of Tokachi and Kushiro-Nemuro have extensive ash and diluvial surfaces.

In contrast to the mild mesothermal climates (Cfa) of Old Japan, this northern island of Nippon, with its cooler summers, much more severe winters, shorter growing season, and somewhat less precipitation, has a microthermal forest climate (Dfb). These contrasts are made clear in Table 1 where four stations in Hokkaido are compared with Nagoya, a representative Pacific Coast station in sub-tropical Japan. Within the island the principal contrasts are between the milder and snowier west as compared with the more severe interior and east (see Table 1).

TABLE 1*

	Temperature Jan. °F.	Temperature August °F.	Precip. in.	Frost-free Season days	Hours of Sunshine July	Hours of Sunshine Jan.
Hakodate	26.8	70.7	45.8	150	161.5	84.1
Sapporo	20.5	69.4	40.5	130	186.1	84.9
Asahigawa	13.8	68.7	42.3	127	166.9	44.4
Kushiro	19.8	63.7	46.3	141	118.2	164.3
Nagoya	37.9	79.9	67.9	207	215.0	164.5

* Data from, "Meteorological Data for Japan" (in Japanese); published by The Central Meteorological Bureau, Tokyo, 1924.

Asahigawa, in an interior fault basin has a January temperature 7°F. lower than that of Sapporo only a few miles inland from the west coast. Temperatures are abnormally low (63.7° at Kushiro in July) and fog is abundant in summer along the eastern coasts which are paralleled by the cool Okhotsk current. It is noteworthy that while all three of the western and interior stations have strong sunshine maxima in summer with very cloudy winters, Kushiro at the eastern extremity of the island has just the reverse of this situation. A permanent snow cover,

averaging 30-50 cm. deep, mantles most of the island in mid-winter, the depths being much greater on the windward western margins. These climatic differences between east and west are made further conspicuous by associated contrasts in vegetation and soils, broad-leafed deciduous and mixed forests pre-

TABLE 2

Mean Maximum Depth of Snow Cover (in cm.) over the Five Year Period 1925-1929

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Sapporo (west)	13	59	98	110	100	27	0
Kushiro (east)	3	23	29	32	22	5	1

dominating in the southwestern half, while conifers of the boreal forests are abundant to the north and east. Coinciding with the former, Mrs. Mikhailovskaia's map[1] shows a prevalence of brown and slightly podsolized soils while a "complex of podsolized, slightly podsolized and bog soils" predominates in the latter forest area. Many of the alluvial lowlands of Hokkaido unfortunately have very peaty soils. Dr. Seki of the Imperial Agricultural Experiment Station at Nishigahara, Tokyo, groups the Hokkaido soils into three large classes: (1) true podsols only in the extreme northern peninsula; (2) weakly podsolized soils elsewhere over most of the island except where, (3) young volcanic detritus prevails as it does on the southern and eastern margins.[2]

Because of its very recent and slow settlement, the island being for the most part an unoccupied wilderness at the time of the Imperial Restoration 6 or 7 decades ago, Hokkaido in some of its occupance features is peculiarly un-Japanese. The population density (32 per sq. km.) is less than one fifth that of the whole country, while even the prefectures of northern Honshu have densities three times as great. A large share of the total population of 2,800,000 is in the western part of the country with by far the greatest concentration in or close to the Ishikari, the largest, most accessible and most fertile lowland.[3] In general the physical environment of this northern

[1] Mrs. O. N. Mikhailovskaia: On The Soils of Japan: *Contributions To The Knowledge Of The Soils Of Asia*, Vol. I, Academy of Sciences of the U. S. S. R.

[2] *Ibid.*, Figs. 2 and 3.

[3] Other lowlands, besides being smaller, are less fertile, diluvium and ash rather than new alluvium predominating.

island is not attractive to the Japanese for few are availing themselves of the opportunity to obtain free land even though traveling expenses to Hokkaido, and in addition a small cash stipend, are paid by the government. In the years 1923-1926 inclusive an average of only 381 families migrated annually to the northern island from Old Japan and settled on the land.[4] In some years the number returning from Hokkaido to the southern islands equals or even exceeds the number entering. Extractive industries (fishing, mining, lumbering) are relatively more important in these higher latitudes than in sub-tropical Japan.

Population is primarily rural there being only three cities with more than 100,000 people and three others of 50,000 to 100,000. Four of these have tidewater locations and are important local ports. Most of the larger settlements appear to have been planned, their grid patterns and wide streets showing occidental influence. The buildings within the towns and cities are usually modified types of Old Japan, but the surprising thing is that they are so little modified considering the severity of the climate. It is amazing to see with what stubbornness the Japanese have sought to preserve in this colder land their traditional mode of living. Much of the flimsy construction common to Old Japan has been copied here. Tile and thatch as roofing materials, although not absent, are however less common, shingles and galvanized iron tending to replace them. Solid immovable walls made of wood siding, with glass windows, take the place of the sliding "shoji" and the mud-plaster walls so common in sub-tropical Japan, while heating by stoves is common. Rural dwellings are very diverse in form. There is no prevailing type for immigrants arriving from various parts of Nippon have transplanted the regional peculiarities of house construction with them. Isolated, individual farmsteads are the rule, the rural family usually residing on the farm and not in a village. There are, to be sure, market towns which serve the dispersed rural population, these commonly having much wider streets of more perfect grid pattern than do their older counterparts farther south. There seems to be a tendency for rural population to be more agglomerated in restricted valleys. As a

[4] *The effect of the Colonization Program Permitted by Hokkaido,* issued by The Colonial Dept. of Hokkaido, 1929.

consequence of the larger land holdings, requiring more animal labor, barns and outbuildings adjacent to the farm-house are more numerous and extensive than in southern Nippon. There is frequently a definite "barnyard," containing a stable, sheds, wagons, and manure piles. Sleds are conspicuous, reflecting the heavy winter snows. Horses replace cattle almost exclusively as beasts of burden, the ratio of horses to farm households in Hokkaido being seven to eight times that of Old Japan. Farm or field fences are almost unknown.

In many parts of agricultural Hokkaido one is impressed by the emphatic grid pattern of land holdings and roads. This reflects a system of land survey adopted in 1899 and patterned after the rectangular system of surveys in the United States. Three units of land subdivision were recognized: the largest, 675 A. (5400 ft. sq.); the next, one-ninth the above area (75 A. and 1800 ft. sq.) while the smallest was one quarter of the middle unit, or 12.5 acres (900 x 600 feet) and was estimated to be the amount of land required to support a family. This smallest subdivision therefore became the common farm unit, corresponding somewhat to the American quarter section.[5]

The average farm (cultivated area) is 11 acres in area; more than one third exceed 12½ acres, while 50-60 per cent of the farm families cultivate 7-8 acres. In paddy areas land holdings are somewhat smaller than where dry crops prevail, although the rectangular pattern still persists and the individual rice fields are only a fraction of an acre in size. It is usual for the land holding to be in one contiguous plot. Individual fields in dry crops are not infrequently from one to several acres in area which gives the landscape a degree of coarseness unlike that of Old Japan. At times one is reminded more of the mosaic of agricultural fields in Europe or America.

In two marked respects Hokkaido's cereal agriculture differs from that of the country as a whole: (1) the less emphasis upon rice, and (2) the general absence of multiple and winter-cropping, both features reflecting the more severe climate with cooler, shorter summers and severer winters. While rice is

[5] During the 10 years following 1870 Gov. Kuroda of Hokkaido brought in a total of 75 foreign experts to that island, of whom 45 were Americans. See, *American Influence Upon the Agriculture of Hokkaido*, published by The College of Agriculture, Tohoku Imperial University, Sapporo, Japan, 1915.

still the most important single crop[6] in Hokkaido, it occupies only 24 per cent of the total cultivated area as contrasted with 54 per cent (40 per cent of total crop area) for the entire country. Only along the cool foggy Okhotsk Sea, and the Pacific littoral east of Cape Erimo is rice absent. Through the development of short-maturing varieties of rice, yielding much less per unit area, there has been a rapid expansion of paddy area in Hokkaido during past decade (63,900 cho in 1917 to 186,000 cho in 1930), somewhat at the expense of other crops.[7] The somewhat larger paddies with a definite rectangular pattern remind one of "adjusted areas" in Old Japan. Because of the short growing season, about one half of the rice is sown directly in the paddies and is not transplanted from seedbeds.[8]

TABLE 3

Area Planted to Various Crops in Hokkaido*
Figures in Cho (2.45 acres)

	1917	1930
Total cultivated area	746,500	831,879
Rice	63,900	186,869
Beans (soy, azuki and kidney)	171,700	234,000
Oats	63,200(1914)	114,222
Potatoes	76,100	45,163
Millets	20,900	16,500
Barley and naked barley	31,300(1918)	20,287
Wheat	10,700(1918)	13,616
Buckwheat	18,400	21,275
Maize	20,600	16,312
Flax	19,700	8,589
Peppermint	.....	13,803

* Data for 1917 from, Wellington D. Jones, Hokkaido: *Geog. Rev.*; Vol. 11, 1926. pp. 16-30. Data for 1930 from The Seventh Statistical Volume of the Ministry of Agriculture and Forestry, 1930, (in Japanese) Tokyo, 1932. Agricultural statistics for subdivisions smaller than prefectures are available in, Report of the Results of Agricultural Investigation, 1929, (in Japanese), published by The Cabinet Statistical Bureau.

Practically all of the Hokkaido crops are spring sown, the fields remaining fallow in winter. Tea is entirely absent, while mulberry, so universal throughout sub-tropical Japan, is insignificant. Apples, beans and potatoes take the places of tea and mulberry as commercial crops. In spite of the fact that the statistical volumes make no mention of hay crops, fields of clover, alfalfa, and timothy are conspicuous, giving evidence

[6] If one combines the acreages of various bean crops,—soya, kidney and azuki—then rice is the second crop.

[7] Total increase in cultivated area from 1917 to 1930 was 85,300 cho or 11 per cent, while the rice acreage increased 122,000 cho.

[8] J. W. Robertson Scott—*The Foundations of Japan*, London, 1922, p. 337.

of a satisfactory climate for these occidental grasses. There appear to be no improved pastures. The dairy industry is somewhat less neglected here than elsewhere in Nippon, Hokkaido having one fourth of the milk cows, but producing 60 per cent of the country's condensed milk and 80 per cent of its butter. More farm families have a milk cow, while in the vicinity of the cities, especially on the Ishikari Plain, dairy farms with herds of holstein cows, hay barns and silos, are not unusual.

What manufacturing development has taken place—lumber, paper and pulp, brewing, fish canning, smelting of metals—is based primarily upon local raw materials, paper and metals being most important. About one sixth of the nation's timber cut (by volume) is from this northern island. There is no marked regional concentration of industrial plants, although the most conspicuous ones are either in the port cities along the south coast, or on, or adjacent to, the Ishikari Plain, at Otaru or Sapporo.

Scores of fishing settlements dot the coasts of Hokkaido, for the catch is large, amounting to one sixth to one fifth the total for Japan. In general these fishing villages appear to be cruder and more dilapidated than are the agricultural villages. Some contain temporary shelters for the fishermen during particular seasons. "Strassendorf" form is common, with wave-cut cliffs often forming the landward boundary, while the strand on the village's ocean side is cluttered with small boats, trays of drying fish, boiling kettles, racks of kelp, storage sheds and other accessories of the fishing industry. Hokkaido has no first-class commercial ports, Hakodate, Otaru and Muroran being the only ones having any foreign trade and this almost exclusively with eastern Asia.

Subdivisions of Hokkaido

Region 1. Peninsular Hokkaido

Separated from the main mass of Hokkaido by the Ishikari-Yufutsu tectonic depression, the peninsular part of the island is a northward continuation of the central and western highlands of northern Honshu. Peninsular Hokkaido like its coun-

terparts in northern Honshu is divisible into two unlike segments, separated by fault valleys, a western hill land composed chiefly of Tertiary rocks, and two eastern volcanic mountain areas.

1a. THE OSHIMA HILL COUNTRY.—Where the weak Tertiary rocks prevail, mature hill country of moderate relief (usually not over 500 m.) is the rule. In the drainage basins of the larger streams there is flattish river-terrace and flood-plain land of considerable extent which has been brought under cultivation. Dry crops predominate but rice is not absent on the lower levels. The hills themselves have a deciduous woodland cover, this resource being used more for fuel, in the form of either wood or charcoal, than for lumber. In spots where andesite and granite replace the Tertiary rocks the land is higher, more rugged and little occupied.

Conspicuous marine terraces, some of them over 200 meters in elevation, border the coast. Along Volcano Bay the railroad follows the very narrow coastal plain close to the ocean margin, with abrupt terrace fronts very obvious on the land side. Crops are raised both on the narrow sandy strip of lowland at the base of the sea cliff, especially on the little alluvial fans, and on the terrace surfaces. Villages along the coast obviously combine fishing and agriculture in their economies, heavy sharp-prowed fishing boats being conspicuous. The west coast is much more abrupt, cliffed headlands are numerous, rail service is lacking and population is sparse.

1b. THE VOLCANIC LANDS.—This division is composed of two fragments separated from each other by the calderon-like depression occupied by Volcano Bay. Its confused landscape is dominated by ash and lava cones (some of them active) in various stages of degradation, by calderon lakes and dissected andesite uplands. The apparent confusion and lack of system in the landforms is due to the contacting of several systems, each associated in origin with respect to a particular point of eruption. Some of the volcanic cones are majestic in their height, one of them rising to nearly 1900 meters. In general the mountainous nature of the region has discouraged settlement, although in some of the valleys and on the low gently sloping ash aprons, agriculture is practiced, while important fishing

villages occupy the coastal margins on both the north and south coasts. Along the south coast at Tomakomai is an extraordinarily large pulp and paper mill with over 1500 employees, using timber from the mountainous hinterland. In this same region are some of the largest Ainu settlements in Hokkaido—agglomerations of frame-and-thatch huts.

Definitely associated in a cause and effect relationship with the igneous activity are the small deposits of copper, iron, gold, silver and sulphur which support mining communities of variable size. At least four sulphur deposits of the solfatara type are being worked. At the Kunitomi Mine not far south-west of Otaru, 156 workmen are employed in producing copper, silver and gold, amounting in value to 609,000 yen in 1930. The Kutchan Mine in the same vicinity is one of the two most important iron mines in Japan Proper, employing 78 men and producing in 1929 60,000 tons of 45-50 per cent limonite, all of it used in the iron and steel plant at Muroran on the shores of Volcano Bay. The reserve is very small, being estimated at only 6,000,000 tons.

Three of Hokkaido's largest cities, all of them ports, lie on the margins of these volcanic lands. *Muroran,* a city of 56,000 and now the third port of the island, has had most of its development during the last three or four decades, this being associated with the export of coal from the nearby Ishikari or Yubari coal field with which it has rail connections by way of the southern arm of the Ishikari-Yufutsu lowland. The city's site is the concave side of a spit and its land-tied island, the whole shaped like a fish-hook, enclosing a well protected harbor. The city's particular claim to manufactural renown is that it contains the second largest iron and steel unit in Japan. There are four blast furnaces, one third of whose ore is supplied from the local Kutchan mine and the remainder from China and Chosen. Unfortunately the plant is not along the waterfront. Coal arrives by rail from the Yubari Field about 250 kilometers to the northeast on the eastern margins of the Ishikari Plain. Two batteries of coke ovens of 30 ovens each produce an inferior, brittle coke from the local Ishikari coal. A modern by-products plant is adjacent. The steel manufacturing unit is equipped with 24 open hearth furnaces although only three of them were

operating in 1928. Specialization is mainly in castings, forgings and special steels, this plant being one of the largest producers for the Japanese navy. Through the port of Muroran pass, for the most part, bulky raw materials—coal, lumber, pulp and paper, and fish products—as exports, and iron ore and limestone for the blast furnaces as imports. Exports greatly exceed imports, coal comprising two thirds of the outgoing cargo. A very conspicuous and modernly equipped coaling pier extends nearly 1200 feet out into the harbor, for this is one of the two principal exit points for Yubari coal, the other being Otaru. Some boats anchor at buoys and are loaded by lighters. Large coal-storage yards occupy waterfront locations. East of the coal pier is another equipped with cranes, serving principally the smelting industries within the city. Depths of 10 meters are maintained in midharbor so that boats of 8,000 tons can be accommodated at one of the buoys.[9]

Hakodate (197,000) at the extreme southern end of Peninsular Hokkaido is the metropolis of the island and closely rivals Otaru for first place as a port. In kind of harbor and site occupied it resembles Muroran, being on a fish-hook peninsula composed of a strongly fortified island (over 300 m. high), and a narrow spit by which the latter is tied to the mainland. Unlike Muroran however, Hakodate in un-Japanese fashion spreads up the adjacent hill slopes for 40 meters or more in picturesque fashion. It is one of the five oldest ports of Japan open to foreign trade and was for a time a summer base for the British Oriental Squadron. As a consequence of these contacts, Occidental influence is conspicuous, especially in the considerable number of ancient semi foreign style buildings. Although Hakodate is a fortified site, as well as the most important business focus of the island, and a local manufacturing center (cement, fish products, hemp cloth and fish nets) of some importance, its dual function as a fishing and ferry-port gives it chief distinction. As one of the nation's greatest fishing centers, it serves not only as the collecting and distributing center for Hokkaido's aquatic products, but for those from Sakhalin and Siberian waters as well. The harbor is characteristically crowded with fishing craft, and marine products are its single

[9] Dr. Ludwig Mecking: Japan's Häfen, ihre Beziehungen zur Landesnatur und Wirtschaft, *Mitt. Geogr. Gesell in Hamburg*, Vol. 42, 1931, p. 573.

most important trade commodity, comprising one-half of the exports. Fish manure is especially noteworthy. Being at the southern extremity of a hilly peninsula, without an important local hinterland and well removed from the more important agricultural, forest, and mineral regions, Hakodate is nevertheless in a position to profit by its proximity to Honshu and its position as the southern terminus of the Hokkaido railway system. These advantages have made it an outstanding domestic-trade port, its coastwise commerce in 1926 amounting to 480,000,000 yen. Foreign trade, chiefly in marine products, and with Asiatic countries and the United States, is less than one thirtieth the above amount.

Otaru (145,000) on the north coast of the volcanic province, has for its hinterland the Ishikari Plain, earliest settled and most productive part of Hokkaido, as well as the Yubari Coal Field. The sea margins of Ishikari are smooth and harborless with coastal dunes, so that Otaru, occupying a rocky indentation in the adjacent andesite hills, has developed as its port. The bay opens to the northeast so that a protective mole and breakwaters have been necessary, depths inside the breakwaters being 7-8 meters. Transfer of cargo is almost exclusively by lighters although boats of 4,000 tons can come alongside the 300-meter coal pier.[10] Great coal and lumber storage yards occupy portions of the waterfront. Marine and agricultural products, principally legumes, together with coal, comprise the outstanding export groups. Coal is largely a domestic export, going principally to the ports of northwestern Honshu, and consumed as bunker fuel by the numerous fishing and coasting steamers. European as well as Japanese lumber-shipping firms have offices in Otaru, some of the product going directly to European (chiefly British) markets. Herring is the outstanding fish of the region, a portion of the catch being turned into fertilizer and oil, the great iron boiling kettles and ovens along portions of the waterfront attesting to this industry. Not only the excellent fishing grounds adjacent, but the abundance of cheap bunker coal as well, has fostered the development of fishing. The domestic trade of Otaru is less

[10] Mecking, *op. cit.*, p. 580.

than half Hakodate's and its foreign trade somewhat less as well.[11] Wheat imported from the United States is processed in a local flour mill.

Region 2. The Ishikari-Yufutsu Lowland

This asymmetrical Y-shaped depression which separates Hokkaido into two very unequal eastern and western parts, is the northern counterpart of the Kitakami-Abukuma tectonic lowland which in northern Honshu marks the boundary between the Inner and Outer Zones. In a very real sense it is the heart of Hokkaido for it is by far the most extensive alluvial lowland in the island and as such has become the focus of agriculture, and its concomitant industries and settlements.

This extensive detritus-filled depression, whose floor has resulted from rapid aggradation by adjacent volcanoes as well as the river Ishikari and its tributaries, is monotonously flat and much of it is poorly drained. The rivers wander sluggishly over its flat surface in very shallow channels, describing broad meander belts where scars of old crescentic channels are numerous, not a few of them containing ox-bow lakes. Large areas of wet peat bog are still unreclaimed for agriculture and support only tall wild grasses and reeds, although some of the none-too-fertile peat soils are now growing a crop of rice. Certain it is that drainage handicaps offer the most serious obstacle to more complete occupance of the Ishikari Lowland. In spring when the heavy snow cover is melting the plain is a quagmire. Where it fronts upon the ocean the coasts are bordered by barrier beaches with dunes, their smooth contour providing no natural sites for ports. Extensive fragments of diluvial terrace flank the inner margins of the lowland, most of them having considerable areas of smooth to rolling upland surface. Volcanic ash is a large constituent of the terraces and their surface soils.

Its accessibility to Old Japan, as well as its comparatively large area of new alluvium, are important reasons why Ishikari was one of the first parts settled, and why at present it con-

[11] In 1928 Hakodate's and Otaru's foreign trade amounted to 15,000,000 and 23,000,000 yen respectively but in 1930 the figures were 40,000,000 and 19,000,000.

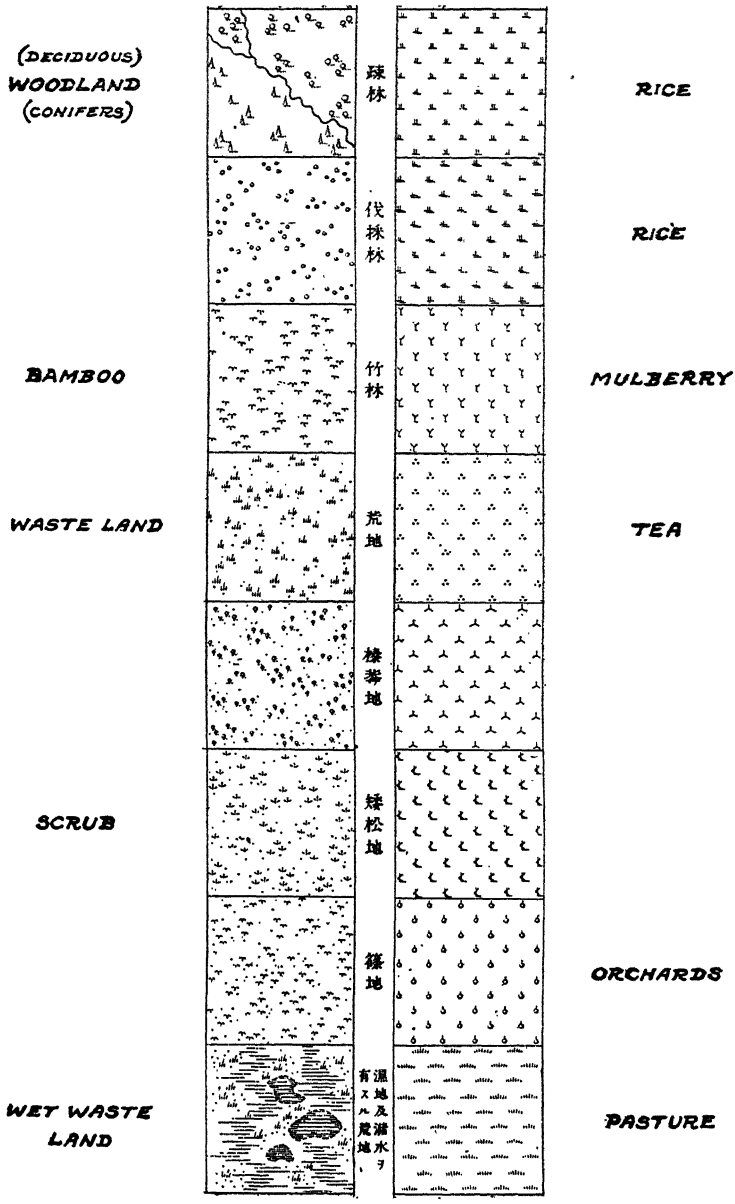


FIG. 16.—Legend for Japanese topographic maps. Numerous illustrations to follow in the monograph are sections of Japanese topographic maps. The above legend will not be repeated for each illustration. Elevations shown in meters. It should be emphasized that many dry crops such as vegetables and small grains have no distinctive symbols. Such cultivated areas are evident on the topographic maps because of a lack of any symbols.

tains the largest population cluster in Hokkaido. Except for the large voids in swampy areas, the rectangular road system and the dispersed isolated farmsteads are characteristic of most of the plain. There is a tendency for the isolated farmsteads to congregate along the highways but this is far from universal. Market villages frequently occur at the intersections of main roads. Surrounding the homesteads and paralleling the highways, rows of trees, often poplars, break the force of the strong winter winds as they sweep across the flat terrain, piling up the snow. The highways are broader than in Old Japan, elevated, and are paralleled by drainage ditches. Relatively large horses in single harness drawing heavy two-wheeled carts, equipped with wide high wheels are conspicuous on the highways. Teams of horses are rare however. The Ishikari Plain is the center of Japan's dairy industry so that one's eye is attracted by holstein cattle in some of the farmyards, as well as conspicuous hay barns and silos. Maize is considerably in evidence. It is in the vicinity of Sapporo that these features are most common but one

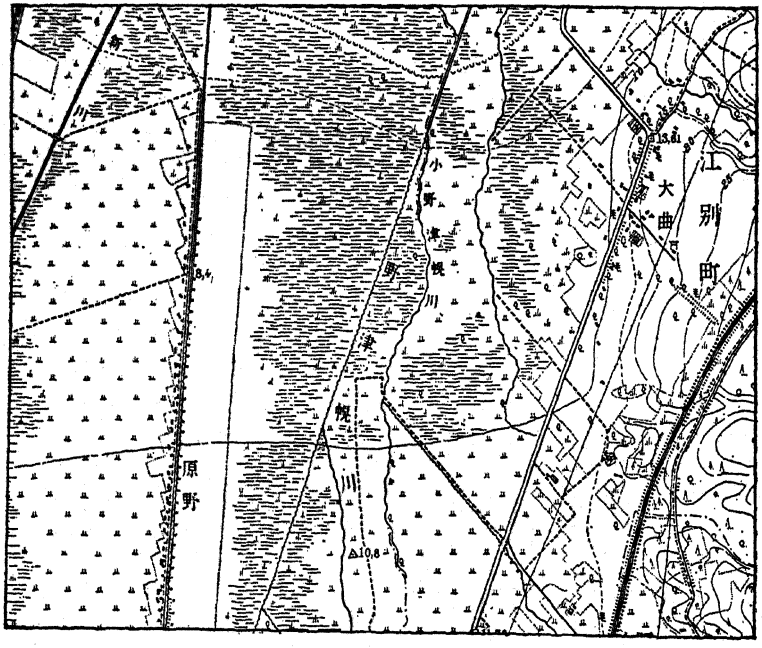


FIG. 17.—A representative poorly drained section of the Ishikari Plain, Hokkaido. The principal crop is rice. Dry crops occupy portions of the diluvial terrace along the eastern margin. Scale 1:25,000. See plate 24.

sees large numbers of milk cans at the railway station and on the trains, indicating that milk is being brought from some little distance. The cattle are fed at the farmstead and were never pastured as far as I could see, although occasionally horses and cows were tethered along the roadside. Fences are rare. The most conspicuous crops are rice, hay, corn, beans, oats and potatoes.

The Ishikari Lowland is an important rice region, in parts of the plain that crop occupying 50 to 75 per cent of the total cultivated area although this is the exception. No doubt the combination of a large amount of wet land unfit for dry crop cultivation, plus relatively warm summers, has been influential in causing paddy specialization. Gradually the peat bogs are being reclaimed and converted into paddy fields, so that there tends to be a concentration of this amphibious crop in the wetter parts of the plain. The monotonous rectangular pattern of small paddy fields in the exclusive rice areas presents quite a

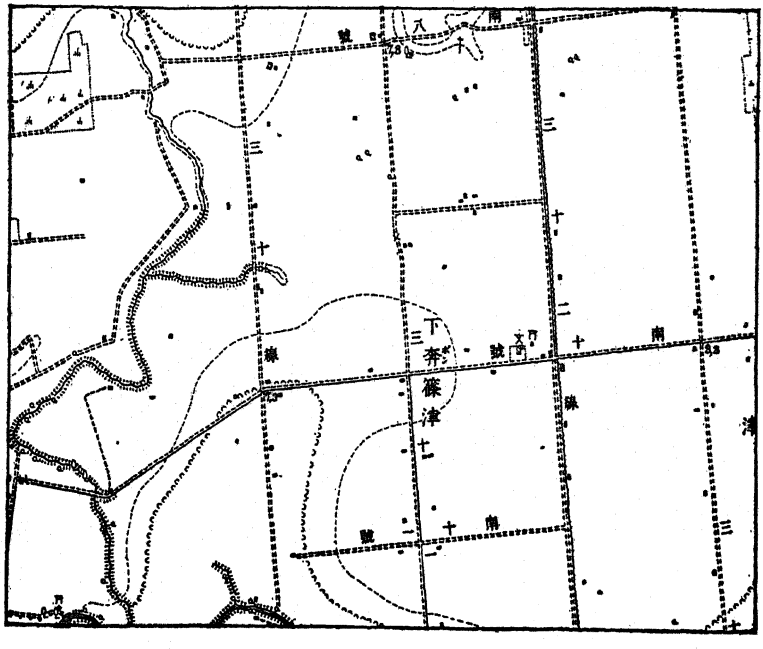


FIG. 18.—A drier section of Ishikari with unirrigated crops and rectangular road system. Note the dispersed and isolated farmsteads. Scale 1:25,000. See plates 23 and 25.

different and altogether less variable landscape than is true of those regions where dry crops prevail.

The peripheral diluvial fragments, with elevations of 30-40 meters above the alluvial floor, have a somewhat contrasting utilization. Their rolling surfaces, poorer ash soils, and incised streams, generally preclude rice cultivation. Large areas are in woodland, some of it good timber, much of it not. Near Sapporo there is considerable utilization of the terraces for dry crop agriculture, giving them an appearance not unlike the dry crop areas on the alluvium except for the rolling surface, occasionally deeply cut by ravines and gullies. In places apple orchards are conspicuous. By and large, however, woodland seems to predominate.

In summary it can be stated that the Ishikari-Yufutsu Plain presents four general types of rural landscapes—(1) the unreclaimed peat bogs, (2) the more exclusive paddy areas on the lower lands, (3) dry crop areas with some rice on the slightly higher alluvium, and (4) the partially cultivated diluvial terraces.

Sapporo, (169,000), capital and metropolis is located close enough to the hard-rock hills so that there is sufficient slope of the alluvium to provide drainage. It is a planned city on a flat plain, unhampered by topographic configuration. Avenues 160 feet wide intersect at right angles with streets 100-120 feet wide, providing an almost perfect grid pattern, and these were laid out before a single house was built. The commercial core has a number of substantial foreign buildings, with at least one large department store. Industry in Hokkaido is somewhat concentrated in Sapporo and on the rail line which crosses Ishikari from the Yubari Coal Field through Sapporo to the port of Otaru. In Sapporo there are large breweries, a spinning and weaving mill for flax, and a spinning mill for hemp yarn. At Ebitsu on the railroad east of the city is one of the largest paper mills in Japan. The industries in Otaru have already been mentioned.

Region 3. Eastern Hokkaido

The roughly rhombic shape of eastern Hokkaido is occasioned by the arrangement of its mountains, the north-south axis

being a series of ranges corresponding to the Pacific or Outer Zone of North Honshu. The eastern angle has as its framework a formidable volcanic range, a westward extension of the Kurile Arc which intersects the north-south mountains at nearly right angles. Extensive plains of new alluvium do not exist, and even the small ones are so wet as to be largely unfit for cultivation. The two largest areas with flattish surfaces are the Tokachi and Kushiro-Nemuro lowlands in the southeastern quadrant, but these are largely diluvium and ash-covered platforms. Its more severe continental climate, in conjunction with greater isolation from Old Japan and lack of well drained alluvial plains, has resulted in eastern Hokkaido still being very much of a frontierland. Throughout this region the extractive industries, lumbering, fishing and mining, give employment to a relatively large proportion of the population.

3a. Hill and Mountain Lands with their Associated Depressions.—3a[1] *Teshio Hills.*—The landward margins of this subdivision are marked by fault scarps overlooking the Central Fault Depression and the northern arm of the Ishikari Plain. Structurally it is an upwarped block composed chiefly of Tertiary rocks, whose surface configuration is relatively subdued, only the highest peaks exceeding 800 meters. Toward the southern end a huge dissected shield volcano presents a much more rugged mountainous relief. Along the coasts, marine erosion platforms are conspicuous. A representative coastal landscape shows dilapidated huts of fishermen and farmers strung out along the highway that closely parallels the sea shore. Occasionally there is a tiny compact settlement at the mouth of a valley where a secondary road meets the coastal highway. On the land side of the highway the abrupt wave-cut front of the terrace rises to an elevation of 30 to 60 meters. Both on the narrow plain at the foot of the terrace, and on the latter's upland surface, some land is cultivated, dry crops predominating. Isolated residences are common. Behind the terrace rise the higher hills, covered with deciduous and mixed woods, or showing moorlike areas. In the valleys that are wide enough to contain flattish floodplain and river-terrace land, a frontier type of agricultural settlement prevails. Toward the northern extremity of this subdivision where real podsols prevail, sum-

mers are so cool and short that most cereals disappear, vegetable crops predominating. This northern extremity is beyond the rice zone. At the little port of Wakkanai, connection is made by boat with Karafuto or Sakhalin.

The Teshio River, after draining a portion of the Central Fault Depression, crosses the Teshio Hills in an antecedent gorge. A wide barren barrier beach with dunes marks the coastline at this point while back of the beach is an extensive swampy lagoon-lowland which is being gradually filled with estuarine deposits. Only small parts of the (1) *Teshio Delta* are cultivated, this being on the northern frontier of rice.

At the extreme southern end of the Teshio Hills is the relatively unimportant Ishikari oil field, its 60± wells having a total output of only 81,000 barrels in 1930.

3a^2. *The Central Fault Depression.*—This rift valley is composed of four waste filled basins (from north to south: Tombetsu, Nayoro, Kamikawa and Furano), separated from each other by low passes. Most of them contain conspicuous remnants of high river terraces. Because of interior locations their climate is extraordinarily severe, at Asahigawa the mean of the daily minimum temperatures for January being 1.4°F., and of the daily maxima for July nearly 80°F. A railroad follows the depression throughout its entire length.

(1) *Tombetsu Lowland* (farthest north) is unlike the others in that it is not a distinct basin with appreciable width of detritus-covered floor. Rather, it is a relatively narrow river valley containing distinct terraces. Agricultural occupance seems relatively meager, the isolated farmsteads look new, and the fields often contain stumps and girdled trees indicating that it is a recently-settled frontier region, only shortly reclaimed from the forest. The villages seem to be primarily logging and lumbering centers, saw mills and huge piles of logs being conspicuous features of their landscapes.

(2) *Nayoro Basin*, next to the south, although it is 40-45 miles long has a distinct alluvium-covered floor, 2 to 4 miles in width, and in places double this dimension if the terraces are included. A considerable proportion of the valley floor is poorly drained and unused, although within recent years new settlers

have reclaimed large areas and planted them to rice, so that paddy landscape is very conspicuous. On drier portions of the basin floor and on the rolling terrace uplands adjacent, the larger fields of dry crops prevail. The rectangular system of highways and land subdivision, and the isolated farmsteads remind one of Ishikari. However, there are two conspicuous differences: (a) the stumps and girdled trees in many of the fields proclaim the Nayora Basin to be a more recently settled region, while (b) the huge piles of logs and lumber in the little settlements testify to the greater importance of the forest industries. Some of the farmsteads look new and unweathered. In traveling northward from Sapporo the Nayoro Basin is the first region where girdled trees and stumps in the fields are conspicuous.

Next to the south, the (3) *Kamikawa* or *Asahigawa Basin* is less enlongated and more octopus-shaped, with several valleys converging radially upon a central core or basin. It differs

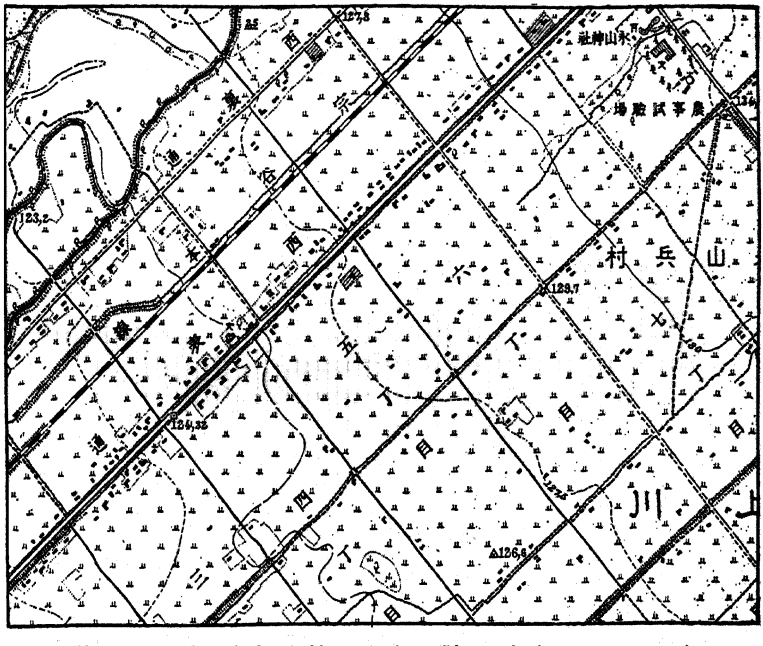


FIG. 19.—A section of the Asahigawa Basin. Rice predominates. A rectangular pattern of roads and farm subdivisions, together with isolated farmsteads, prevails. A section of the riverine belt with dry crops is evident in the northwest corner. Scale 1:25,000.

from the other basins in being much more densely populated and more completely utilized. The relatively well-drained floor contains little wasteland, most of it being covered with paddy fields laid out in rectangular pattern. This is one of the most exclusive rice areas in Hokkaido, parts of it having 90 per cent of the crop land in this one crop. Stumps and girdled trees are absent. Rectangular roads and dispersed dwellings prevail. It is much more like Ishikari than like northern Hokkaido. Along the streams there is often a slightly irregular riverine zone where dry crops prevail while similar utilization is made of parts of the adjacent terraces, which have been cleared of their woodland cover. Asahigawa, (83,000) the metropolis of north central Hokkaido, is a focus for railroads from all directions and has developed into an important collecting and distributing commercial city. As headquarters of the seventh army division it acquires additional fame. Its broad streets of rectangular pattern remind one of Sapporo.

The fourth and most southerly basin, (4) the *Furano*, is relatively small. Its northern part is poorly drained but where it is not a waste land, rice predominates. The alluvial piedmont farther south has the usual rectangular landscape common to dry-crop areas in Hokkaido.

3a[3] *Yubari Hill and Mountain Land.*—Structurally the Yubari region is a tilted block, its more elevated and rugged eastern front having an elevation of 1,500 m. and more. On the backslope to the south and west relief and elevations are more characteristic of hill country, although slopes are steep. Only the principal stream valleys have sufficiently wide flood plains to permit important agricultural occupance.

However the fame of this region rests chiefly upon mineral wealth, for the Tertiary hill country along the western margin of the Yubari Range contains the single largest reserve of coal in Japan. The field, designated as Ishikari or Yubari, occupies a narrow belt 80-100 kilometers north-south by 16-24 kilometers east-west. The strata have been considerably disturbed by foldings and faultings so that the coal seams have relatively steep (15° to 50°) inclinations. The coal is bituminous of fair quality and makes only a relatively poor grade of coke. There are ten to a dozen large mines and many more

small ones. Due to the recent development of this field the mining equipment is relatively more modern than it is in the Kyushu fields. At at least 7 points along the north-south line of railway paralleling the eastern margin of the Ishikari Plain, branch lines leave the main line and work back along the small river valleys to the coal mines in the hills, thereby developing a trellis transport pattern. Yubari coal serves that part of Japan from about the latitude of Tokyo northward, most of the export passing through the ports of Otaru and Muroran.

At the southern end of the Yubari Hills is the unimportant Karumai oil fields, producing less than 47,000 barrels in 1930.

3a[4]. *Hidaka Mountains.*—Excepting the volcanic peaks, these are the highest mountains of Hokkaido, at least one elevation exceeding 2,000 meters. An abrupt and bold fault scarp, the northern half of which is maturely dissected, terminates the range on the east, the western back slope being less precipitous. Settlement is of course meager, being confined to the river valleys and to certain upland depressions in which sediment has accumulated. These latter locations are conspicuous along the railroad route which crosses the range. Minerals are almost entirely absent. Multi-cycled marine abrasion terraces with sea cliffs are conspicuous along the south coast, the southern tip at Cape Erimo having a wave cut platform 320 meters in elevation with a maximum horizontal depth of 15 kilometers. Small combination fishing-agricultural settlements, approximating "strassendorf" pattern, parallel the highway which traces a course almost along the waters edge, while isolated farm residences are conspicuous in the short but wide bottomed valleys cut in the weak Tertiary rocks adjacent to the coast.

3a[5]. *Kitami Mountain Land.*—North of the Volcanic Range and east of the Central Fault Depression is a mass of subdued mountainous topography and rugged hill country, developed on igneous and sedimentary rocks. Over much of the region the highest elevations range between 750 and 950 meters although in the western part they exceed 1,000 meters. The western margin of this upwarped block is a fault scarp descending to the Nayoro Graben. Occupance is relatively meager and recent for the farmsteads appear new and the frontier characteristic of stumps and girdled trees in the fields is common. Except for

a little gold, mineral production is unimportant, forests providing the chief source of extractive wealth. The most conspicuous features of the little towns along the railways are the huge piles of logs, and not infrequently a sawmill.

Its coastal margin along the Sea of Okhotsk is bordered by a very broad (1) *marine terrace,* often terminating in low abrupt sea cliffs at the water's edge. The highway and railway usually follow the outer edge of the terrace. Where small rivers reach the sea coast there are little bulges of wet delta material, a number of these sites containing small, gray, fishing-lumbering-agricultural hamlets. River-mouth location is further significant since these valleys are the natural routes by which logs are brought to the coastal railroad. In these valleys and on the marine-terrace upland are scattered stump-cluttered fields of the recent settlers, but even much of the level land remains in trees or waste land. Sections of the coast have barrier beaches capped with dunes and back of them extensive lagoons. Rice is entirely lacking along this north coast, the summers being too cool, foggy and short for its cultivation. Of outstanding importance in this region as a commercial crop is peppermint, the area planted amounting to 30,000-35,000 acres. Apple orchards, in certain localities, are likewise conspicuous.

The chief concentration of population is in the eastern part of the region in (2) the *Nokkeuse Basin,* in which, because of its interior location, resulting in higher summer temperatures, some rice is grown. The basin floor is gravelly and wet, and waste land is conspicuous. River terraces are beautifully developed around the margins of the basin, the relatively large rectangular fields of dry crops, with their various colors and hues, reminding one somewhat of an American rural landscape.

3a[6]. *The Volcanic Chain.*—Three separate volcanic groups composed of strato, shield and lava-dome volcanoes, in various stages of dissection comprise this mountain mass. The easternmost and largest of the three groups consists of a central core of volanoes, with calderon lakes, surrounded by extensive ash aprons. In general the ash uplands are in woods or moorlands and not cultivated. Some of the river valleys and their terraces contain frontier homesteads, with crops planted among the stumps and girdled trees. In the vicinity of Abashiri, the

only commercial port of the north coast, the seaward margins of the ash apron are relatively well cultivated, as are the drier parts of the swampy lagoon plain. Abashiri, a city of only a few thousand people, has a relatively poor exposed harbor which is frozen in winter, so that regular steamship service with Otaru is maintained only with difficulty.

The central and western volcanic masses are smaller in area but are high and formidable and have less extensive ash aprons. One cone attains an elevation of 2290 meters. Settlement is extremely meager.

3a[7]. *Shiranuka Hill Land.*—Between the Tokachi and the Nemuro-Kushiro Lowlands is a region of weak Tertiary rocks which stream erosion has reduced to hill-country stature. Maximum elevations do not exceed 600-700 meters and the slopes, covered with mixed forests, are only moderately steep. Relief averages 200-300 meters. On the aggraded alluvial floors and on the terraces of the river valleys, agricultural settlement is relatively well developed, but on account of the cool foggy summers little rice is grown. The lower ends of the valleys are often swamps. The abrupt coast is bordered by marine abrasion platforms, the railroad in places running along the inner margin of the beach at the base of a sea cliff, while in other places it follows the crest of the lower terrace. Occasional frontier homesteads and little cultivated clearings on terrace platforms can be seen from the train. Along the immediate coast there is the usual number of fishing villages, each surrounded by a restricted hinterland of cropped fields, and many of them containing large piles of logs. When I was in this area in August fog was so dense that observation was extremely difficult.

3b. South Eastern Lowlands.—3b[1]. *Nemuro-Kushiro Terrace.*—In the extreme southeastern part of Hokkaido is a marine abrasion surface of such extent that it takes on the aspects of a plain. In places it may be traced inland as far as 50 kilometers, the wide, flat, or gently sloping, inter-stream areas being covered superficially with ash and diluvial deposits. Much of the upland surface is under 75 meters elevation. The shallow, steep-sided valleys, and the flat interstream areas* in-

* In the western portion north of Kushiro the inter-stream uplands are less flat.

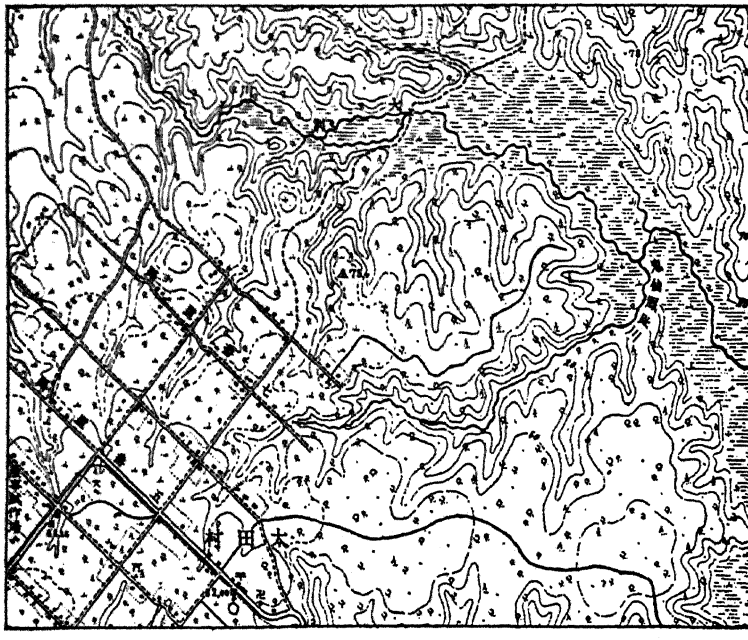


FIG. 20.—A section of the Kushiro-Nemuro terrace. Swampy valleys and flattish upland in cut-over woodland are typical. A portion of the upland here shown is a frontier settlement area. Scale 1:50,000. See plate 26.

dicate an incipient stage of erosion. A man-altered vegetation cover, consisting of cut-over woods and moors, mantles the area. The valley floors are excessively swampy, resulting perhaps from recent slight submergence. The entire eastern and southeastern coast is washed by the cool Oyasiwo current from Bering Sea, the southward surge of cold waters being most marked in summer. As a result the region has a summer deficiency of both sunshine and heat, with dense fogs common in June and July. Both Kushiro and Nemuro have 86 days with fog, about one half of the days in the months of June, July and August being foggy. Inland portions suffer less. May at both stations has a mean daily maximum temperature of only 51°F. while in June at Nemuro it is only 57°, and at Kushiro 58°. As a consequence of these low spring temperatures, cereals are sown at least a month later here than elsewhere in Hokkaido. The soils, which are largely weathered ash, are not only very infertile in their virgin state, but in addition stubbornly resist improvement.

What with its cool foggy summers, severe winters, infertile soils, and wet swampy valleys, together with its isolated peripheral location, this Kushiro-Nemuro area has been avoided by the agricultural settlers in Hokkaido, so that it is today one of the most complete frontier regions of the island. Much the larger part still remains unoccupied. Population pressure in Old Japan is forcing a small stream of unwilling emigrants into this inhospitable northern and eastern region where they eke out a rather meager livlihood. Out of 1445 immigrant farm families settling on government lands in Hokkaido during the four-year period 1923-1926, 790 took up farms in the Nemuro-Kushiro area.[12] In addition to the 10 cho (25 acres) of land with which the immigrant family is endowed, there is a cash bonus of 300 yen ($150 at par) to aid in building a cabin, and provide tools, seeds, fertilizer and work animals. Very light and narrow-gauge railways, together with a system of roads, both government financed, are making various parts of the region available to farm seekers. Relatively large fields, often several acres in size prevail, stumps and girdled trees being conspicuous in many of them. Buckwheat is the most important crop, with rape, oats, peas, millet and soy beans following in the order named. Naturally handicapped as this region is in the production of cereals, its cool, moist, foggy climate would seem to better fit it for grasses and the animal industries. In traveling through the area one sees horses in considerable numbers pasturing on the indigenous grasses.

Along the coast are the usual dismal fishing settlements, for this is one of the most important fishing littorals of Hokkaido. The piles of logs and the sawmills in the villages reflect the importance of still another extractive industry. Kushiro (52,000), the metropolis of eastern Hokkaido, is the one significant commercial port of that region. It owes its original development to fisheries and even today aquatic products are an important item in its export list. More sailing vessels, many of them fishing craft, entered Kushiro in 1929 than any other Hokkaido port. Some 400 Kushiro vessels are engaged in tunny fishing, the annual catch being valued at 2,000,000 to 4,000,000 yen. The

[12] *Effect of the Colonization Program Permitted by Hokkaido*, Pub. by Colonial Dept., Hokkaido, 1929. (In Japanese).

principal outgoing freight is coal, wood (including pulp and paper), and to a less extent, farm products. There are several minor coal fields in eastern Hokkaido but in all of them the seams are thin and the product of inferior quality, so that mining operations are carried on chiefly in the Kushiro hinterland where some 250,000 tons are excavated annually, much of it being used for bunker and locomotive fuel. Reserves are stimated at 300,000,000 tons.[13] Kushiro has only a shallow (2.3 m.) river-mouth harbor and is further handicapped by the prevalence of dense summer fogs. The streets are characteristically muddy. Most of the freight transfer is by lighter although there is a coal pier at which small boats can come alongside.

Nemuro, on Cape Noshappu at the eastern extremity of the island is the principal Hokkaido port in the Kurile trade. Emphasis is emphatically upon marine products. Thick fog in summer and ice in winter greatly handicap navigation so that most boats operate in and out of Kushiro only from April to November.

3b^2. *Tokachi Lowland.*—Unlike Kushiro-Nemuro, the Tokachi Plain is not a marine abrasion terrace. Rather it consists of unconsolidated coastal-plain, fluvial and ash deposits of Diluvial age, resting unconformably upon an irregular surface of Tertiary rocks. Certainly volcanic detritus comprises much of the surficial cover. The Tertiary basement rocks are exposed in places along the valley sides, and over considerable areas they rise above the diluvial surface as "islands" or spurs of higher and rougher land. Along the western margin of Tokachi at the foot of the Hidaka fault-scarp is a piedmont zone composed of fan and talus deposits. Over most of the area however, the diluvium consists of terrace benches at several levels, probably representing stages of uplift. The Tokachi River and its tributaries have further complicated the relief by adding a series of alluvial river terraces, so that the entire lowland is composed of relatively smooth flattish or sloping surfaces at a variety of levels. The margins of the terraces are sometimes precipitous; more frequently the transition from one level to another is less abrupt. From certain vantage points

[13] Kyukichi Watanabe: Coal Resources of Japan; *Conference Proof, No. 15*; World Power Conference Sectional Meeting, Tokyo, 1929.

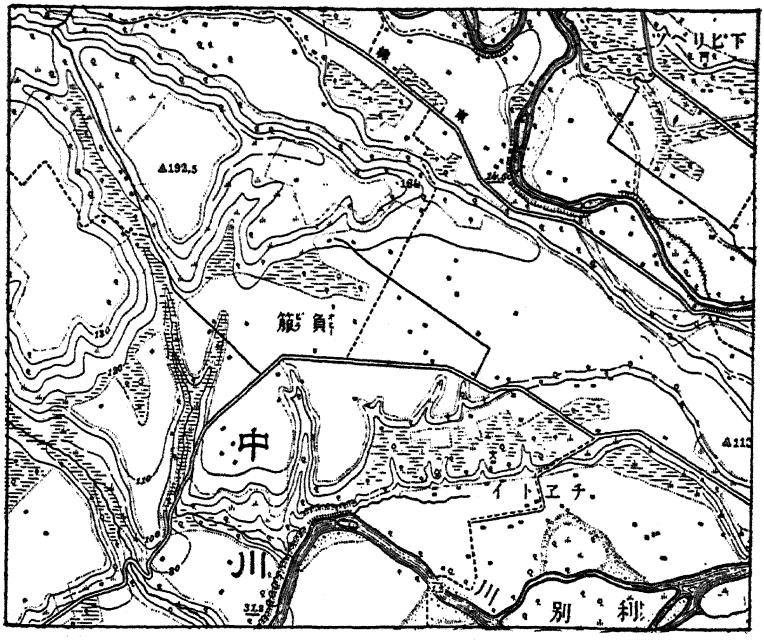


FIG. 21.—A section of the Tokachi Plain. At least four flattish terrace levels are here represented. Dry crops and isolated farmsteads predominate. Scale 1:25,000.

one can view the conspicuous and even sky lines of the higher terraces extending for miles unbroken. The immediate flood plains of the rivers, especially along the lower course of the main stream, have a great deal of swamp and peat-bog. Along the coast, except at the mouth of the river, a wave-cut cliff of diluvial terrace ends abruptly almost at the water's edge.

Along the Tokachi littoral, summer months are cool and foggy resembling the Nemuro region farther east. At Obihiro in the interior of the lowland, on the other hand, early summer temperatures are 5° to 8°F. higher and at the same time winters are 6° to 10°F. colder indicating a distinctly more continental type of climate.[14] The original vegetation cover in this region was deciduous and mixed forest, the only part of eastern Hokkaido where this type of woodland predominated. While the ash soils admittedly are not fertile, the Colonial Office in Sapporo was of the opinion that they are one degree better than

[14] Obihiro has average January and July temperatures of 12.4°F. and 67°F. respectively. Precipitation amounts to 38 inches, concentrated in summer and autumn, September having three to four times as much as February.

those of the cool foggy Kushiro-Nemuro region farther east, which is within the "cold-forest zone" where needle trees are prominent.[15]

In its completeness of occupance and density of population Tokachi appears to be intermediate in position between the Ishikari region to the west and Nemuro-Kushiro to the east. The Colonization Office at Obihiro stated that there was still sufficient satisfactory government land in the region to take care of 5,000 additional immigrant farm families, although the influx amounts to less than 200 families each year. The land still available for colonization is on the higher, less accessible and more remote terraces and fans, now in cut-over woodland. On these more elevated sand and gravel benches, obtaining an adequate water supply is something of a problem.

The present concentration of agricultural population is on the lower-diluvial and the alluvial terraces, and on the immediate flood plains as well, when the latter are not too poorly drained. Dispersed settlement and a rectangular system of land subdivision and highway pattern prevail. Lying as it does close to the rice frontier, paddy land is not conspicuous in the area, occupying only 11,000 cho out of a total of 163,000 cho of cultivated land in Tokachi gun. It is largely confined to the low alluvial lands along the rivers. Among the dry crops, beans of various kinds far exceed all others, occupying over 50 per cent of the cropped land. It is a commercial crop, large quantities of the dried product being shipped to Old Japan. Tokachi is also the center of sugar beet culture in Nippon, there being a refinery at Obihiro. Other than these special forms of cultivation, the usual run of dry crops prevails.

There being no port along the smooth and abrupt Tokachi coast, Kushiro serves as the outlet for agricultural produce emanating from the basin. This is the least important part of the entire Hokkaido littoral, even fishing villages being largely absent. Within the lowland, the two cities of Ikeda and Obihiro, both of them on the railroad and at confluence sites, serve as local merchandising centers.

[15] Mikhailovskaia includes the soils of Tokachi within the "brown-soil" group, while those of Kushiro-Nemuro are within the "podsolized and slightly podsolized" soil region.

B. OU (Honshu North of about 37°)

Not only in position, but likewise in climate and culture, Ou is transitional and intermediate in character between Hokkaido to the north and sub-tropical Japan south of 37°. Being a part of Old Japan, south of the Tsugaru Strait, its total resemblances are more with the south than with Hokkaido; nevertheless earmarks of the north are conspicuous.

Like Nippon in general, Ou is a hilly and mountainous region. The meridional trend of its land-form features is extraordinarily conspicuous, three parallel ranges of highland being separated from each other by longitudinal depressions of tectonic origin. It is the more eastern of these two lowlands which serves as the line of demarcation between the Inner and the Outer Zones.

In contrast to Hokkaido with its Dfb climate, all of lowland Nippon south of the strait is Cfa, Ou being on its poleward margins. Hot-month temperatures vary from 72°F.-73°F. in northern Ou, to 76° F. along its southern margins. Due to the cool Oyasiwo current along the east coast, the Pacific side has cooler (2° to 4°) foggier summers than the Japan Sea coast.[16] Occasional rice failures result during abnormally cool summers. January temperatures vary from 27° in the north to 33° in the south. A frost-free season of 160 to 200± days is usual. In amount and distribution of precipitation, the opposite coasts are also in contrast, the smaller amount on the Pacific side being concentrated in the warm season, while on the west side winter precipitation equals or exceeds that of summer, most of the former falling as snow. Nearly all of Ou has a winter snow cover but it is much less deep on the Pacific side and ceases to be permanent south of Koriyama (37½° N.).

The original vegetation cover was "temperate forest" with deciduous trees (maple, birch, chestnut, poplar and oak) predominating, although mixed forests were very common. The southern boundaries of this "temperate forest" and the brown

[16] Stations along the east coast have 20 to 36 days with fog, practically all of it concentrated in the warm months.

soils (at low elevations) fairly well coincide with the southern boundary of Ou. At higher elevations in northern Honshu, conifers and deciduous trees representative of the "boreal forests," prevailed.

Population density in Ou is definitely intermediate in character between the regions to the north and to the south. The three northernmost prefectures have densities of less than 100 per sq. km. while in the southern ones it averages 100-150.[17] As elsewhere in Japan close coincidence prevails between river-aggraded lowlands and dense settlement. Moreso than in any other large division of Japan, the lowlands of Ou are interior rather than coastal in location so that population is concentrated upon interior basins as well as upon littoral plains, causing an unusual dependence upon rail transport. East and west coasts stand in marked contrast to each other, the former having only one conspicuous lowland while the latter has several.

Like Old Japan and unlike Hokkaido, an agglomerated type of rural settlement is most common, although individual farmsteads are by no means absent. In the extreme north residences greatly resemble the somewhat more substantial and winter-proof frame houses of Hokkaido, and shingle or galvanized iron roofs take the place of thatch. On the whole life is lived in a cruder fashion in this northland region. Large cities are relatively rare, Sendai (190,000) and Niigata (125,000) being the only ones whose populations exceed 100,000. Of first-class ports there are none.[18] Manufacturing is meagerly developed, silk reeling, concentrated in the southern half of Ou, which is a part of the Central Honshu specialized sericulture region, being noteworthy. The railroad net has a conspicuous ladder pattern with the main north-south lines following the meridional depressions and the western littoral, while shorter east-west lines make connections across the mountains. Along the east coast a rail line runs north from Tokyo only as far as Sendai, from which point it continues northward in an interior valley.

The agricultural landscape of Ou has a number of transitional characteristics. Farms average 3½ to 4 acres in size, approximately one third the area of Hokkaido farms, but 1½ to

[17] The density for all of Japan is 169; for Hokkaido it is only 32.

[18] There are only 15 cities with over 20,000 inhabitants; two of these with over 100,000, seven between 50,000 and 100,000 and six between 20,000 and 50,000. Six of the 15 are in interior basins.

2 times the size of those in middle and southern Japan. Paddy fields ordinarily lie fallow in winter and are not planted to a second crop of cereals, while on the snowy western side, fall planting even on upland fields is not a common practice. In the extreme northeast, following the Hokkaido practice, some grain crops are sown in spring. Six critical crop boundaries are to be noted within Ou: the northern boundaries of tea and sweet potatoes lie near its southern margin; a north-south line following approximately the Central Mountain Range separates the regions of winter as well as summer cropping (east), from those where planting is done more exclusively in summer (west); at approximately latitude 38° is the northern boundary of bamboo and also of fall-sown cereals in the rice fields, while important mulberry cultivation terminates somewhere between parallels 39° and 40°. As previously stated, a vegetation, and perhaps a soil boundary as well, approximately coincide with the southern margins of Ou.

Subdivisions of Ou

Region 1. The Eastern Highlands

Two spindle shaped highland masses, designated as Kitakami (north) and Abukuma (south), separated from each other by the Sendai Lowland, comprise this easternmost division of Ou.

1a. Kitakami Hill and Mountain Land.—This more northern of the two highlands is composed of complicated old sedimentary formations and ancient intrusives which were once peneplaned, then elevated into a domelike structure, and subsequently reduced to slopes by normal river erosion. External features do not conform to internal structure. A steep and dissected flexure scarp marks its descent on the west to the Kitakami river valley. Remnants of the old peneplain surface still exist at about 1,000 meters elevation but monadnock peaks rise several hundred meters higher. The higher central portion can best be described as subdued mountains which on all sides descend to lower, but still rugged, hill country. The northern one-third of the coast has suffered emergence so that it is smooth in contour and is characterized by high terraces of marine abrasion

and deposition with abrupt wave-cut fronts. The southern half of the coast on the other hand has experienced subsidence, resulting in a deeply indented ria type of coast line with rugged wave-notched peninsulas enclosing narrow bays 4 to 6 kilometers deep.

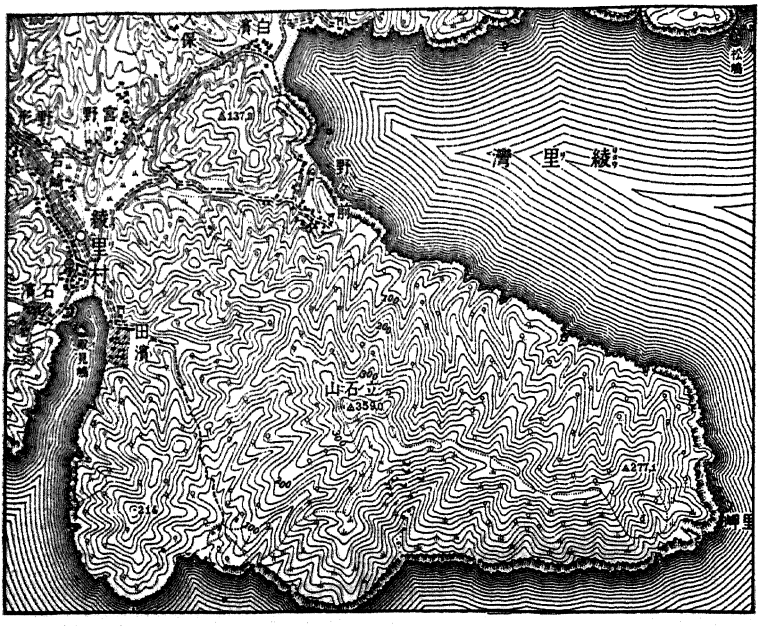


FIG. 22.—A section of the deeply indented and precipitous coast of southern Kitakami Highland. The little bay-head settlements are combination agricultural-fishing villages, the sardine catch being especially important in this region. Scale 1:50,000.

The relatively meager population, (under 50 per sq. km. in the northern half) is concentrated in the labyrinthine valleys and on the tiny delta fans at the heads of deep southern bays. Both isolated farmsteads and small rural villages are common. In such a region where level land suited to irrigation is so meager and where summers are inclined to be cool, rice is relatively less important than in most parts of Ou, occupying less than 20 per cent of the cultivated land over one-third to one-half the area. Millet, beans, barley, buckwheat and vegetables are the important dry crops, occupying lower hill slopes as well as competing with rice for parts of the valley floors. In the northern part of Kitakami some of the cereals are grown as summer, as well as winter, crops. Along the northeast coast

where smooth terrace surfaces are common, the inter-stream uplands are largely in woodland but with some cleared land in dry crops, while rice largely monopolizes the valley floors. Some of the farmers of western Kitakami make a specialty of horse-raising, using the hill slopes for pasture lands. Along the much indented southern coast fishing is intensively developed, sardines making up three quarters of the total catch. The residents of the little bay-head delta towns are fishermen as well as farmers. No railroad parallels the coast so that the seaway is the highway. Only one rail line crosses the highland from east to west and that well toward the south where it is lower and narrower.

The one significant ore body in Kitakami is a small contact metamorphic magnetite deposit located inland about 20 kilometers from the port of Kamaishi. Relief is relatively great in the vicinity so that the ore beds outcrop 1,500 feet above the nearest drainage level, requiring wire cables to carry the ore down to the valley below. There are in the Kamaishi deposit only 14,000,000 tons of high grade iron (50-60 per cent) and possibly 35,000,000 additional tons of low grade ore (averaging 30 per cent) so high in silica as to be at present of no value.[19] Other than the one in Hokkaido, this is the only body of iron ore in Japan which is large enough and rich enough to warrant the erection of a smelting plant adjacent. At Sudzuko, a suburb of Kamaishi, located about one mile from the coast, are two 200-ton blast furnaces, one of 60 tons, and one of under 25 tons capacity, representing the largest iron smelting unit in Japan outside of Yawata in North Kyushu.[20] Local ore, and imported coal and coke arriving by boat from Hokkaido comprise the raw materials. Three open hearth and one electric furnace convert the pig into steel, the product being almost exclusively round bars.

At Kuji, a small coastal city on the northeast coast of Kitakami, there has recently been erected a $1,500,000 plant for smelting the iron sands occurring in old beach deposits on terraces 500-1,000 feet above sea level. The ore body, largely low grade hematite and limonite (33-40 per cent), containing a

[19] Economic and Trade Notes, No. 232, U. S. Dept. of Commerce. Trade Inf. Bull. 573, U. S. Dept. of Commerce.

[20] Ranks after Muroran in Hokkaido if steel capacity is included. See Trade Information Bull. 612.

high percentage of titanium oxide, is estimated to have a reserve of 150,000,000 to 1,000,000,000 tons, but the recoverable amounts are unknown. At the sea-level smelting plant in Kuji, using Hokkaido coal, the ore is reduced to finely powdered sponge iron, pressed into 4 in. x 5 in. briquettes, and shipped to open hearth furnaces in other parts of Japan. At least partly due to metallurgical difficulties in using this ore, the Kuji plant has been closed for several years, experiment being too expensive. "It is generally admitted that the problem of producing this type of iron as an essential part of the Japanese iron industry has not yet been solved."[21] Nevertheless as an emergency supply of ore in time of war it may be significant.

1b. ABUKUMA HILL LAND.—Like Kitakami, Abukuma is an uplifted and dissected peneplain of complex structure. It differs from Kitakami in, (1) being composed chiefly of granite instead of old sedimentaries; (2) having elevations averaging only one half as high; (3) being bordered on its sea side by a narrow belt of low Tertiary hills and coastal plain from which it is separated by a fault scarp; and (4) containing numerous fault valleys. The upland surface is strongly rolling but scarcely to be described as rugged. More complete peneplanation was experienced in Abukuma than in Kitakami so that there is greater uniformity of upland levels and larger remnants of the abrasion surface remaining.

Reflecting its lower altitude and latitude, its wider valleys and closer proximity to Kwanto, density of population (100-150 per sq. km.) is twice to three times that of Kitakami. Along the western margins there are several relatively open alluvial-floored drainage basins with hills of low elevation where there are important nodes of agricultural settlement. Isolated farmsteads are abundant. Rice and mulberry are both relatively more important in this southern hill land than farther north, while to some extent winter cropping of paddies is practiced.

In southern Abukuma, about 5 miles inland from Sukegawa Station, is one of the relatively large copper deposits of Japan. This one, Hitachi, which is of hydro-thermal replacement origin, developed adjacent to a diorite intrusion, averages 2 to 4 per cent pure copper. The hilly terrain in which the mine is lo-

[21] Trade Information Bulletins 573 and 612.

cated makes it economical to transport the ore by aerial tram to the smelter located at Daioin 2½ miles distant from both the mine and Sukegawa Station. Still farther down the valley from Daioin, and connected with it and Sukegawa by an electrical railway, is the refining plant with a wire-drawing and electrical-equipment mill adjacent. The smelter and refinery serve not only the Hitachi mine but others in the northeastern part of the country as well.[22]

1b[1]. *The Coastal Belt.*—Where rivers pass the abrupt fault scarp marking the eastern margin of granitic Abukuma, and enter the narrow belt (5 to 6 miles wide) of weak shales and

FIG. 23.—A section of the coastal belt of the Abukuma Highland. Beach ridges occupy the seaward margin with a filled-lagoon lowland behind them. Farther inland are the dissected Tertiary and diluvial uplands. Scale 1:50,000.

sandstones which parallels the coast, their valleys widen immediately and the inter-stream uplands, often flattish marine abrasion or deposition surfaces, are low in elevation, usually under 100 to 150 m. In the wide alluvial-floored valleys rice is the all-important crop although riverine belts are often dry

[22] The Hitachi Copper Mine. Guide-Book Excursion C-2, Pan-Pacific Science Congress, Tokyo, 1926.

cropped. The sea margins of the valleys are bordered by low dune-capped beach ridges behind which are occasional lagoons. These elevated beach sites are also common locations for dry crops. The inter-stream terrace uplands ordinarily terminate at the water's edge in low wave-cut cliffs. Where there are considerable areas of flattish diluvial upland the woodland cover has been partially removed and dry crops planted, but the irregular surfaces of the Tertiary hills are usually in trees. Artificial ponds are numerous, the impounded waters furnishing irrigation water for valley paddies. A major highway and railway follow this coastal lowland connecting Tokyo and Sendai.

In the southern half of this coastal belt is the Joban Coal Field, the third most important producing field in Japan. Half a dozen large mines and numerous small ones produce 2,000,000 to 3,000,000 tons of inferior bituminous coal a year.[23] Being only 160 kilometers from the Tokyo-Yokohama industrial area, Joban coal finds its principal market in that region. A serious handicap to mining is the frequent upwellings of enormous amounts of hot water in the mines, often doing serious damage.[24]

Region 2. The Eastern Lowlands

2a. Mutsu (Sambongi) Diluvial Plain.—Elevated fluviatile and marine sediments here form an extensive seaward sloping plain whose inland margins, where they merge with the ash aprons of several volcanoes of the Central Range, reach elevations of 60-70 meters. The smooth crescentic coast line is formed by beach ridges behind which are shallow lakes and partially filled lagoons. The wide alluvial-floored river valleys are likewise so wet that large areas are swampy wasteland, although much has been reclaimed for rice. Paddy landscape in such locations is monotonously uniform with scarcely an object to mar the broad expanses of inundated fields, the villages seeking drier sites along the margins of the valleys.

The flattish or slightly rolling upland surfaces have three contrasting cover-forms: moorland, woodland and cropped

[23] Reserves are estimated at 305,000,000 tons.

[24] Shigeyasu Tokunaga: Geologic Structure of the Joban Coal-field, *Proceedings of the Third Pan-Pacific Science Congress*, Tokyo, 1926, Vol. II, p. 1557-1560.

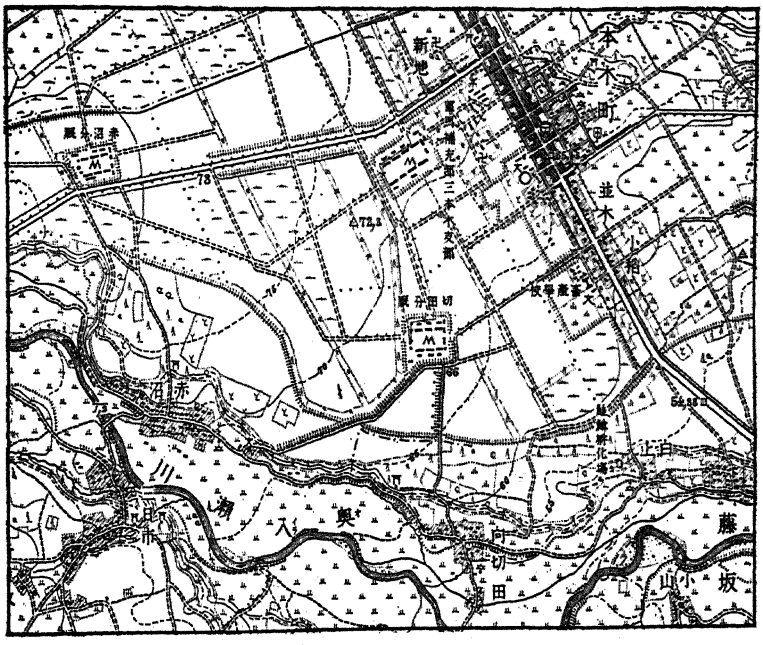


FIG. 24.—A section of the Sambongi diluvial upland. The wet floodplains are planted to rice. The higher levels are characteristically in dry crops, pasture or woodland. Scale 1:50,000.

areas. In some of the cultivated areas the rectangular pattern of roads and land subdivision resembles that of Hokkaido, but the dispersed farmsteads are largely lacking. Other resemblances to Hokkaido landscapes are to be found in the more substantial houses with glass windows and shingle and metal roofs, as well as in spring planted grains. When I saw the region in mid-August, shocked grain in the fields was a conspicuous feature, although I was told that fall planting was also a common practice. Millet is a particularly important crop on these infertile uplands, while on the moor-like areas considerable numbers of horses are grazed; in fact the Sambongi Plain is famous throughout Japan as a horse-breeding center.

2b. KITAKAMI LOWLAND.—The northern part of this meridional tectonic depression, which lies along the western flanks of the Kitakami Highland and drains northward through the Mabechigawa, is only a narrow valley without conspicuous floor area. Throughout this section, ash and lava deposits from the

volcanoes to the west have constricted the lowland so that settlement is not continuous. At Sannoke, where the railroad turns abruptly south, mulberry, of the tree type, first appears in the landscape. It does not occupy plots or fields, but rather the individual trees are scattered somewhat promiscuously here and there, not infrequently being planted along field boundaries. The hardier tree mulberry seems to be better adapted to these higher latitudes of Japan where spring frosts are damaging. In places fruit trees are also conspicuous, apples predominating.

South of the low divide which separates Mabechi from Kitakami drainage, resemblances to Hokkaido landscapes seem to disappear, for cereals here are fall sown, and less substantial thatched houses become conspicuous. From Morioka southward to about the 39th parallel the valley broadens so that it takes on the proportions of a basin. Its western two thirds is occupied by a wide piedmont zone of diluvial-fan material carved by streams into a series of terraces, so that the Kitakami River has been forced eastward where it flows through a relatively

FIG. 25.—A section of the diluvial piedmont along the western margin of Kitakami Lowland. The upper stonier part of the fan is chiefly woodland or waste-land. Dispersed settlement prevails. Scale 1:50,000.

narrow flood plain against the flanks of the Kitakami Highland.[25] Except for a riverine belt containing dry crops (vegetables, winter grain, mulberry and fruit trees) the flood plain is largely in rice. Since the paddies are not sown to winter grains, rice is planted relatively early and when I saw the district in mid-August the crop was ripening, being far more advanced than rice in south western Japan from which I had just come, where double cropping of paddies is customary. The diluvial piedmont, although dissected by streams, still has considerable areas of flattish or moderately-sloping surface and large parts of such areas have been cleared and are in farms. Not only the usual dry crops, but rice as well is conspicuous, the artificially terraced paddies occupying various levels. Numerous artificial ponds provide irrigation water. Patches of woodland together with frequent scattered fruit (apples, peaches) and mulberry trees, and homesteads surrounded by hedges and windbreaks, give to the piedmont belt a confused and cluttered landscape so that extensive views are rare. On the piedmont zone dispersed settlement is the rule, while on the lower flood plain isolated farmsteads, and compact villages as well as transition forms are represented. Morioka (62,000), the capital of Iwate Prefecture, is an old castle town of the Nambu Family and is at present famous for its horse fairs, Nambu ponies from Iwate being known throughout Japan.

South of parallel 39° the diluvial piedmont belt disappears and the character of the Kitakami depression changes. Here complicated faulting with subsequent vertical movement has occurred so that at present irregular masses of low Tertiary hills, archipelagic in character, stand out above equally irregular alluvial-filled depressions. The hill masses are thoroughly dissected, rice occupying the labyrinthine valleys, while the slopes are largely in grass or tree covered. Along the lower slopes dry crops, especially mulberry, occupy significant area. In this milder region the more sensitive bush mulberry has largely displaced the tree variety and the silk industry is significantly important. The alluvial lands are low and wet, swamp and lake being prominent. Great expanses of monotonous paddy

[25] It is significant that the conspicuous diluvial piedmont accumulations throughout the eastern longitudinal depression of Ou are on the western sides of the basins. This probably reflects not only heavy rainfall along the high Central Range, but also the abundance of easily removed volcanic ash which characterizes it.

landscape, much of it "adjusted," are characteristic, the villages being commonly located along the elevated and diked rivers or along the bases of the Tertiary hills. Riverine zones of dry crops, where mulberry is prominent, are conspicuous variations from the paddy landscape. "Strassendorf" villages are common.

In the gap between the Kitakami and Abukuma Highlands the Kitakami Lowland finally reaches the seacoast and although the littoral plain here is not extensive, it is nevertheless the site of the single compact and important coastal settlement along the whole eastern side of Ou. The coastline is prevailingly smooth with beach ridges along the sea margins, except where interrupted by the cliffed headlands of sunken Matsushima Block, enclosing shallow, island-studded Matsushima Bay. This archipelago of irregular pine-clad islands is one of the "Three Great Sights" of Japan, famed in art and literature and renowned as a resort location for Japanese and foreigners alike. The parallel sandy beach ridges, both to the north and south of Matsushima, are the sites for dry fields, the outermost ridge bearing a wall of conifers which acts as a wind and sand-break. The narrow alluvial lowland back of the beach ridges has on its inner margins rather extensive diluvium-mantled uplands with some flattish surfaces 20-50 meters in elevation.[26] Back of these rise the higher and more irregular Tertiary hills, whose numerous open valleys contain important settlements. This region lies close to the northern limit of bamboo culture as well as fall-sown cereals in the rice fields. Sendai (190,000), whose old daimyo castle occupies a diluvial spur overlooking the whole plain, is the metropolis of northern Honshu, capital of the prefecture and site of an Imperial university. It is neither a port nor an industrial city although it does serve as the commercial focus for the Sendai Bay settlement and for those of the entire Kitakami Lowland at whose mouth it lies. The Abukuma Lowland to the south is served by Tokyo and Yokohama rather than by the Sendai Bay cities. Since most of the important lowlands of eastern Ou are interior rather than coastal, there is an almost complete lack of commercial ports along that side of Honshu between Aomori and Yokohama, this latter city, through rail service, serving as the port of the landlocked basins. Shiogama,

[26] Sendai and Matsushima. Guide Book Excursion C-3, Pan Pacific Science Congress, Japan 1926.

on a shallow indentation of Matsushima Bay and serving the one conspicuous coastal settlement cluster of eastern Ou, is the single port of any consequence as well as the outstanding fishing center of northeast Japan. Recent harbor improvements, including a dredged channel, now permit boats of 3,000 tons to enter and dock at the pier. Its total trade, amounting annually to 50,000,000 yen, is composed principally of imports (salt, coal and oil cake) destined for Sendai, the large consuming center of the district[27]

2c. ABUKUMA LOWLAND.—Although it is the valley of a single northward draining river, the Abukuma Lowland is not continuous, a low divide separating the Fukushima Graben from the Koriyama Basin farther south. Still farther south this same tectonic depression is continued in the northern arm of Kwanto Plain.

2c[1]. *Fukushima Basin.*—Diluvial sediments in the form of piedmont fans fill the northern and western part of the basin. Natural and cultural items of landscape are in most respects simlar to those in the mid portion of the Kitakami Basin, except that in this more southerly depression winters are milder with less snow, mulberry is of the bush variety and occupies much more area, population is somewhat less dispersed, and winter cropping of paddy fields is practiced. Not only on the diluvium but also on the recent flood-plain sediments, mulberry is an important crop, while filatures and cocoon warehouses are conspicuous features in the villages, testifying to a specialized sericulture industry in the basin. Fukushima City, (46,000) a castle town, claims renown chiefly as a silk reeling center. More characteristic of this basin than either the isolated farmstead or the compact rural village is the semi-dispersed or amorphous type of settlement. When I saw the region in August 1932, rice seemed much less advanced here than in the Kitakami region further north, probably because of later planting consequent upon winter cropping of the paddies.

2c[2]. *Koriyama Basin.*—In gross features of landscape there is little to distinguish Koriyama from its smaller northern neighbor. In many respects these detritus-choked basins of Abukuma, specialized as they are in sericulture, remind one of

[27] Mecking, Japan's Häfen, *op. cit.*, 505-510.

the Fossa Magna grabens in central Chubu. Like northern Kwanto, Koriyama is an important tobacco region. This is the approximate southern limit of a permanent snow cover on the Pacific side of Japan.

Region 3. The Central Mountain Range

Emphatically a watershed, this medial range of northern Honshu is a climatic, and perhaps to a less degree, a culture divide as well. In structure it is an elongated warped dome with faulted margins, having a core of ancient granites and gneisses whose flanks are covered with recent sedimentary strata. Crowning the range are seven distinct and about equally-spaced volcanic clusters, their cones providing the maximum elevations, at least one reaching 2,000 meters. The copious precipitation of this watershed has been put to use in the form of hydroelectric power and irrigation water in the basins lying to the east and west.

The region is sparsely populated, most of the valleys being gorges with little land suitable for cultivation. In the weak Tertiary rocks along the flanks, elevations are lower, valleys are wider, cultivation is more prominent and irrigation ponds are often numerous. At the extreme northern end of the range along the lower slopes of Mt. Hakkoda's ash apron is one region of conspicuous agricultural occupance, although it is far from dense. More particularly on the wide floors and terraces of the valleys incised into the unconsolidated ash, but to some degree on flattish sections of the interstream uplands as well, settlement has taken place. As pasture sites for the grazing of cattle and horses the ash slopes are also of some consequence. In parts, the Central Range is covered with valuable timber whose exploitation supports small communities, as do the mineral deposits. Gold, silver, copper, iron and sulphur are mined in various sections, copper overtopping all the others in value, at least three mines having an output in 1930 valued at more than 1,000,000 yen. The largest mine, near Kosaka in northeastern Akita Prefecture, employed 2,589 workers and produced 6,500,000 yen of copper and over 1,000,000 yen of gold and silver in 1930.[28]

[28] *Trends of Mining in Japan*, 1930, (English Appendix).

Region 4. The Western Intermontane Basins

The depressed zone lying between the Central and Western Ranges is not continuous but rather is composed of a series of 8 or 10 tectonic basins, some of them distinctly isolated from the others by formidable topographic barriers, so that a continuous rail line from north to south does not follow them as it does the eastern lowlands. Most of the basins are occupied by the headwaters of streams which cross the Western Range in antecedent valleys thereby making these inland settlement areas chiefly tributary to, and hinterlands of, the delta cities and ports along the Japan Sea. All of the basins have larger or smaller areas of flood-plain floor, but at the same time piedmont belts of alluvial and diluvial fan deposits are conspicuous features as they are in the eastern lowlands. In general the major fan deposits originate from streams descending from the Central Range and so are best developed along the eastern margins of the depressions. Climatically these western intermontane basins belong to the Japan Sea side of Honshu, dark gloomy winter weather with heavy snows being characteristic, although the depth of snow cover varies considerably among the basins, depending to what degree they are freely open to winds from the Japan Sea. It is not unusual for these western interior basins to have a greater depth of snow cover than have the littoral plains along the west coast, as is illustrated by the following data for Akita, at the mouth of the Omonogawa, and Yokote along its headwaters in an interior valley.

TABLE 4
Average Maximum Depth of Snow Cover (in cm.) on the Ground for the Years 1925-1929 Inclusive

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Akita	2	30	64	68	41	0
Yokote	0	90	143	151	129	10

These western basins stand out in marked contrast to the eastern depressions in their general lack of winter cropping, not only in the rice fields, but on upland fields as well. Those basins north of the 39th parallel produce practically no wheat, barley and naked barley, which are the principal fall-sown cereals, while even in those south of 39° the above mentioned crops are rela-

tively unimportant. The deep and long continued snow cover, which would compel early planting and late harvesting, thereby limiting the growth of summer crops, has no doubt been an inhibiting factor. The 39th parallel, which was the approximate poleward limit of extensive mulberry culture and important silk spinning in the eastern valleys, is an acceptable boundary for the same forms in the western basins.

In these snowy regions of western Ou, in spite of numerous snow sheds, rail traffic in winter is frequently suspended for days at a time. In certain villages where the snow is excessively deep people are forced to inhabit the upper stories of their homes in order to enjoy daylight. Special forms of architecture, such as wide eaves and covered sidewalks, called "gangi", which when fitted with temporary outer walls in winter provide corridors through which pedestrains may walk, protected from the weather, are common. Shingle roofs likewise appear to be more numerous to the west than to the east of the Central Range.

4a. AOMORI PLAIN, at the extreme northern end of Honshu, is to be sure a coastal rather than an interior lowland, but because it lacks certain characteristic features of the Japan-Sea plains, and moreover since it is a part of that same longitudinal zone of depression along which the western inter-montane basins are developed, I have chosen to include it with the latter group. It is a small crescentic strip of lowland whose inner margins are a dissected diluvial bench, where woodland, rice, dry crops and apple orchards intermingle, which is bordered on the sea side by paddy-covered new alluvium. Settlement is almost exclusively agglomerated. Aomori (77,000) the one significant city of the plain, has no rival among the ports of North Honshu. Its hinterland is not only the immediate lowland, but also the relatively large Tsugaru or Iwaki Basin just to the west which has no port, and the extensive ash and diluvial uplands to the south and east. In a sense much of northern Honshu is served by Aomori. However, like Hakodate, it is not so much dependent upon a local hinterland, but functions rather as the Honshu terminus for the ferry service between that island and Hokkaido and as the northern terminus for the rail lines of Ou. Four boats of 3,500 tons each, daily leave for and arrive from Hakodate, while somewhat less frequent service is maintained

with Muroran. Foreign trade is relatively insignificant although its coastwise traffic of 225,000,000 yen (principally with Hokkaido) gives it a ranking of ninth among Japanese ports.[29] Imports are principally soybeans, fish and fish products, while toward Hokkaido move rice, textile and metal wares, tobacco and petroleum. Not only in freight transfer, but also as a passenger and fishing port, does Aomori have fame. Industries are largely lacking. The harbor faces north on a broad open bay and is exposed to the winter monsoon. This has made necessary the construction of extensive breakwaters enclosing an artificial harbor whose depth is approximately 10 meters.

4b AND 4c. HANAWA (4b), AND ODATE (4c) BASINS, which occupy portions of the Noshirogawa drainage basin are largely floored with diluvium. Some of the diluvium retains its original fan shape but other parts have been carved into a series of flattish river terraces. Compact villages are the usual settlement form, their sites being the lower terraces rather than the periodically inundated flood plain. On August 5, 1932, when I saw the region the floodplain paddies were deeply flooded and the rice crop had been ruined. The lower terrace benches have paddies as well as dry crops, numerous artificial ponds providing the necessary irrigation water. The higher diluvium is largely in woods or is wasteland. Conspicuous features in the villages along the railroad are the sawmills and the huge piles of logs, reflecting the forest wealth of the mountainous upland.

4d. THE YOKOTE BASIN next to the south, and largest of all the western grabens, occupies the upper drainage basin of the Omonogawa. Relatively high volcanic masses separate it from the northern depressions so that rail connection is made with them only by way of the coast. Along the northeastern margins is a belt of diluvial fans whose gravelly upper slopes are largely in woods or waste, dry fields and dispersed farmsteads being conspicuous at lower elevations. On the new alluvium, where rice predominates, the denser population is congregated into compact as well as semidispersed settlements. Definite riverine belts of dry fields and wasteland parallel some of the streams. What, with the very numerous settlement units, the riverine zones, and the maze of roads and irrigation chan-

[29] Mecking: Japan's Häfen, *op. cit.*, p. 554-555.

nels, many of them lined with trees, the plain has a confused and cluttered landscape. Toward the southern end of the basin mulberry becomes outstandingly conspicuous reflecting the increasing importance of sericulture in the vicinity of the 39th parallel.

4e, 4f, and 4g. Occupying portions of the Mogamigawa drainage basin are the SHINJO (4e), YAMAGATA (4f), and YONEZAWA (4g) depressions. In *Shinjo* compactness of form is lacking, it being composed of wide irregular valleys and basins, separated by spurs of Tertiary hills. The latter contain numerous irrigation ponds. Compact settlements prevail. *Yamagata,* more compact and regular in outline, is emphatically specialized in sericulture. Not only on the extensive diluvial piedmont and on the riverine belts, but competing with rice on the new alluvium as well, mulberry is an extraordinarily important crop. Yamagata city (63,000), an old castle town and the present prefectural capital, is famous as a filature center as are most of the large compact towns which dot the plain. *Yonezawa,* less compact, with smaller and more dispersed set-

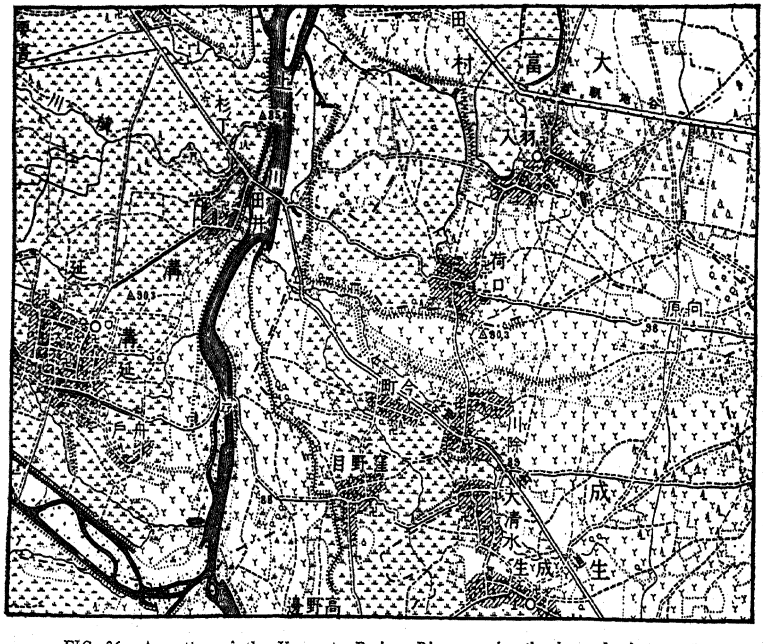


FIG. 26.—A section of the Yamagata Basin. Rice occupies the lower levels, except in the riverine zone where dry crops, especially mulberry, prevail. The eastern portion is diluvial piedmont where mulberry is the most important crop. Scale 1:50,000

tlement units and a generally cluttered and confused landscape, reminds one of the Yokote Basin. Here too mulberry is important. A north-south rail line joins all three basins and extends northward to the Yokote depression. Connection is made with the Japan Sea Coast by two east-west lines following the Mogamigawa and Omonogawa valleys while the trellis pattern is made more complete by two other transverse lines which cross the Central Range and reach the Kitakami and Abukuma Lowlands.

4h and 4i. Along the upper waters of the Aganogawa are the relatively small WAKAMATSU (h) or AIZU, and the INAWASHIRO (i) depressions. Scars of migrant stream channels, with marked soil variations characterize the former so that dry crops intermingle with paddy lands, mulberry being conspicuous. Wakamatsu city (44,000), a castle town, is a filature center. Most of the Inawashiro Basin is occupied by a lake resulting from blocked drainage caused by ash and lava deposits from an adjacent volcano. Delta-fans along its margins support a narrow, interrupted belt of cultivated fields.

REGION 5. THE WESTERN RANGE OF MOUNTAINS AND HILL COUNTRY

Structurally the western range is an elongated dome containing a crystalline core from whose crest in places the sedimentary cover of Tertiary rocks has been removed. Four rivers cross the range dividing it into several segments, these antecedent valleys being the principal rail and highway routes to the interior settlement areas. Somewhat attenuated belts of population and cultivation along these valleys serve to join the larger nodes of culture at their upper and lower ends, completing what is roughly a dumbbell pattern, which is repeated for each of the four drainage basins. Several magnificent volcanic piles occupy in-sinking basins along the western flanks of the range.

5a. TSUGARU HORST is an unimportant hilly region dropping down by abrupt scarps to a narrow alluvial-diluvial plain bordering Mutsu Bay on the east and to the Tsugaru (Iwaki) Basin on the west.

5b. DEWA HILLS, with their highest elevations scarcely ever exceeding 1,000 meters, are more typically hill-country than mountain. Gold, silver, copper and sulphur are mined in small amounts, the principal mine, in 1930, producing copper valued at more than 1,150,000 yen, together with much smaller amounts of gold and silver. In the low Tertiary hills bordering the Japan Sea, in a belt about 170 kilometers long, is the Akita oil field which in 1927 produced 700,000 barrels of petroleum. From the train one is able to discern numerous oil derricks on the hills to the east. An oil refinery at Akita employs 432 men.

5c. ASAKI-IITOYO MOUNTAINS.—South of the Mogamigawa, where granite is much more abundant, relief and elevation are greater so that genuinely mountainous landscape prevails. Abrupt fault-scarp margins are conspicuous on both the eastern and western flanks, that part of the coast between the Mogami and the Niigata Plains, where mountains reach the sea, being bordered by precipitous wave-cut cliffs.

5d. ECHIGO HILLS AND ASSOCIATED GRABENS.—This mass of hilly land, composed of a series of blocks with intervening fault valleys, whose general trend is northeast by southwest, is an intermediate step between the coastal lowlands and the high and rugged mountains of the Central Knot just to the rear. Relief of 200 to 400 meters is common. For the most part dissection has been fairly complete so that settlement is relatively dense for a hill region, both compact and dispersed forms being numerous. In places the upland slopes are relatively mild so that terraced paddies intermingle with dry fields. A very complicated dendritic pattern of paddy land prevails on the valley floors. The wider graben valleys contain much fan material and conspicuous river terraces, as do the fault basins of Fossa Magna. Similarly also, mulberry is a very conspicuous crop.

In these low Tertiary hills bordering the Echigo Plains is Japan's most important oil field, although insignificant in world production, and already declining in yield. The output in 1927 was only 850,000 barrels. There are two refineries, one at Niigata and the other at Kashiwazaki, 70-80 kilometers down the coast from Niigata.

Region 6. The Western Plains of Ou

Along the Japan Sea littoral of North Honshu is a series of five or six aggradational plains, the three northern ones occupying portions of in-sinking kettle depressions which are associated with volcanic activity. In two of them, Tsugaru and Shonai, the basins are partially filled with huge symmetrical ash and lava cones, which tower above the adjacent lowlands. Each of these plains likewise is at the sea end of an antecedent river whose sediment has been deposited in the shallow waters of lagoons lying back of wide belts of beach ridges or bars, capped with dunes. Drainage is generally poor and in some of the plains large areas of swamp and shallow lake still persist. Strong waves and currents generated by the boistrous winter monsoons, have tended to smooth the coast, developing wave-cut cliffs where highlands reach the sea, and barrier beaches and bars along the alluvial portions. Natural harbors are largely lacking and although there is some coastwise shipping, Niigata is the only port-town with a significant trade.

Like all of western Ou these plains are inflicted with dark, stormy, snowy, winter weather. The snow cover is relatively deep so that covered sidewalks or "gangi" are common.

TABLE 5
Maximum Depth of Annual Snow Cover (in cm.).
(1925-1929)

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Takata	0	66	136	177	134	37
Akita	2	30	64	68	41	....

Winter winds are strong, frequently blowing with gale force, Akita during three winter months having wind velocities double those characteristic of Tokyo on the Pacific side of the country. As a consequence, a common feature, especially of those towns near the coast, is the shingle roofs weighted down with boulders. The clusters of miserable fishermen's huts along the shore and on the dunes seem poorly equipped to withstand these winter gales even though they may be protected by windbreaks in the form of hedges, walls of trees, or lattices filled with brushwood or moss. Piles of fuel are tied down to prevent their being dislodged. Fishing is less important along this Japan Sea

coast than on the Pacific side of Ou, the lack of harbors and the rougher seas being natural obstacles.

The low and poorly drained plains are thoroughly specialized in rice, so much so that this cereal is the single most important domestic export from the region. Climatic handicaps have discouraged winter cropping so that small grains (wheat, barley and naked barley) so important to the east of the Central Range are either lacking or unimportant on these western plains. Unirrigated crops occupy cleared patches on the diluvial terraces, riverine strips along principal streams, and wide belts on the series of parallel beach ridges which border the coasts. Silk culture is less important on these western plains than in the Eastern Lowlands or the Western Intermontane Basins of Ou. On the two northernmost plains (north of 39°) mulberry is almost lacking.

6a. TSUGARU (IWAKI) BASIN.[30]—This northernmost of the western basins, and one of the largest (350± sq. mi.), well represents their common characteristics. In at least one respect, its specialization in apple growing, for this is Japan's principal apple district, Tsugaru departs from the normal. It is an alluvial floored structural depression with a wide belt of dune-capped beach material obstructing its sea end. No port has developed along its smooth, harborless, coastline, Aomori only 30 to 40 kilometers distant, serving in that capacity. Even fishing settlements are almost completely absent. The lower end of the basin is wet, considerable areas of shallow lake and swamp intermingling with paddy fields. Completely surrounding the low alluvial floor are terraces of diluvium, covered with a veneer of volcanic ash. Back of these rise the hills and low mountains which enclose the depression and force the railroads to pass the eastern and southern barriers by means of tunnels. Above the western margin of the valley towers the symmetrical ash cone of Mt. Iwaki (1588 m.), which is effective in breaking the full force of the winter gales which fill the basin with snow during winter months.

Population decreases toward the wetter, more exposed,

[30] This subdivision of Ou has been described somewhat in detail in the following publication—Glenn T. Trewartha: The Iwaki Basin: Reconnaissance Field Study of a Specialized Apple District in Northern Honshu, Japan, *Annals of the Association of American Geographers*, XX, No. 4, Dec. 1930, pp. 196-223.

lower (northern) end of the basin. Agglomerated settlement prevails. Except for the wide eaves and covered sidewalks (gangi) evidences of special adaptation of house construction and architecture to the more severe winter weather are not conspicuous. Hirosaki, the metropolis, an old castle city with 43,000 inhabitants, occupies a strategic position on a high prong of terrace and an adjacent portion of the plain, at the convergence of several valleys in the upper end of the basin.

The floor of the depression is largely covered with irrigated rice fields. The principal exception to this paddy landscape is in the riverine belts of variable widths along the main streams, where the terrain is somewhat uneven, and scarred with relict forms of migrating stream channels. Here a variety of unirrigated crops are grown, apple orchards, potato and rape fields being very conspicuous, some of the rape being fall-sown. Both potatoes and apples are grown as commercial crops in this region. The diluvial terraces with their poor ash soils are in part covered with scrubby trees or a moor-like vegetation, although large areas, particularly in the south end of the valley, have a utilization similar to that of the riverine strips, with apple orchards here reaching their most extensive development. Close to 50 per cent of the apple crop of Japan is grown within the Iwaki Basin, giving it a degree of national fame. Reflecting the superabundance of farm labor, each young apple is encased in a paper sack made of newspaper, to protect it from insect and fungus pests. Not only the diluvial benches and the riverine zones, but also the lower mountain foothills, are common locations for apple orchards, although the yields of these slope orchards are not so great. Numerous artificial ponds in the diluvium serve as sources of irrigation water for rice fields on the lower alluvium.

6b. Noshiro-Omono Plain.—Composed of two small aggradational plains at the mouth of the Noshiro and Omono Rivers, together with narrow strips of coastal sediments which enclose Hachiro Lagoon and connect Oga Peninsula to the mainland, this lowland lacks compactness. The northern or Noshiro Plain, is composed largely of low diluvial terrace, most of it uncultivated. Its seaward margins have the usual belt of beach ridges and dunes, a section little occupied and meagerly utilized.

A few depressions have pond-irrigated rice and there is a little dry cropping especially along the inner margins of the dune belt, which is also the site of a highway and villages. Between the beach ridges and the diluvial terrace the meager alluvial area is in rice, only the riverine zone being excepted. Noshiro City, at the mouth of the river is an anchorage port for coastwise steamers, its fame being due to lumber export. Within the city is a large sawmill for handling logs arriving at Noshiro from the mountains by way of the valley route.

The delta-plain of the Omonogawa has many resemblances to that of the Noshiro just described. Strong northward flowing currents cause the river to bend in that direction so that it flows parallel with the coast for some distance back of the belt of beach ridges before breaking through the barrier. Akita (51,000), a castle town, and the site of an oil refinery, is located several kilometers behind the protective wall of pine-capped beach ridges. Its port, Tsuchisaki, 5 kilometers distant and near the mouth of the Omonogawa, is severely handicapped by river floods and its exposed north-facing harbor, traffic practically ceasing during winter months. Its exports are chiefly rice from the immediate plain as well as the tributary interior lowlands, and logs and oil from the adjacent hill and mountain country.

The sandy beach ridges joining hilly Oga Peninsula to the mainland and enclosing between them Hachiro Lagoon, have a marked parallelism of their natural and cultural lineaments, some of the inner ridges having considerable dry-crop cultivation, with rice in the intervening swales. Villages following the ridge tops are of "strassendorf" dimensions. A branch line of railroad follows the southern belt of beach-ridge from Akita to Funakawa, 30 kilometers distant on the southern side of Oga Peninsula, a supplementary port, used principally in the winter when the unprotected river-mouth harbor of Tsuchisaki is unfit for anchorage.

6c. Shonai or Mogami Plain.—Compact and composed entirely of new alluvium, the Mogami Plain supports a very sizable population group, settlement forms, except on the beach ridges, being prevalently small, tree-enclosed clusters of dwellings. A dense network of drainage channels, some having river-

ine belts specialized in dry crops, covers the lowland. Large areas of paddy have been adjusted giving to the landscape a very precise geometric pattern. Considerable portions, especially the inner margins, of the beach-ridge belt, are under cultivation (vegetables, fruit trees and mulberry), more so than is true of similar locations farther north, although protective walls of conifers are very conspicuous on the outer ridges. Sakata, the port of the immediate plain, as well as of the interior basins along the Mogamigawa, has all of the disadvantages of an open roadstead harbor on a stormy coast. Water is so shallow that only lighters and small sailing vessels can enter the river and approach the city. Rice is the single great export; imports are varied. Tsuruoka (34,000), a castle town, located behind the protective wall of beach bridges, has some local fame as a cotton and silk weaving center.

On the northern margin of the Shonai Plain is the lordly volcanic cone of Chokai (2230 m. elevation) the lower and flatter slopes of whose ash apron are partially under cultivation. Along its northwest margins, dissection is so far advanced that a labyrinthine valley-pattern with paddies has resulted.

6d. Echigo or Niigata Plain.—This, the largest of the plains of Ou, is coincident with the greatest population nucleus of northern Japan. Occupying a fault basin, with a belt of parallel beach ridges and dunes one to three miles wide along its sea margins, the lowland is not well drained, containing considerable area of swamp and shallow lake. Across its flat surface wander numerous large and small streams, the story of their shifting courses to be clearly read in the scars of old channels and the ox-bow lakes. By reason of lying to the leeward of hilly Sado Island, and partly because the plain is relatively wide, the snow-cover is less deep at Niigata City than at any weather bureau station along the northwest coast, the maximum depth of snow on the ground in January and February being only 35 and 30 cm. respectively. At Nagaoka, at the southern extremity of the plain, and close to the mountains, the figures are 109 cm. and 129 cm. respectively.[31]

Like a series of giant corrugations, the dozen or more parallel beach ridges, 20-25 m. high, with their intervening trough-

[31] Okada, *op. cit.*, p. 252.

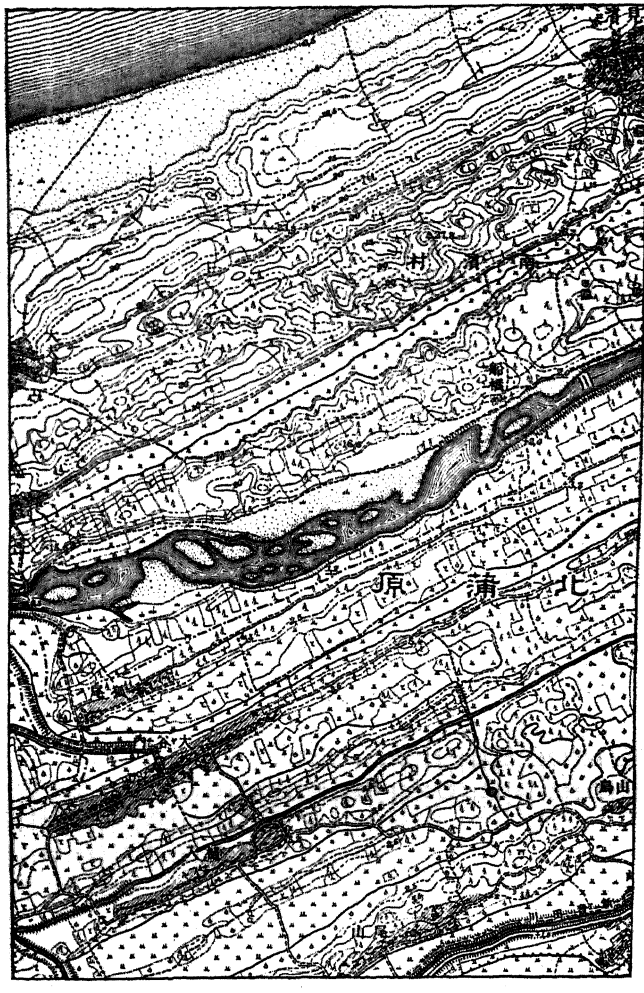


FIG. 27.—A wide belt of parallel beach ridges and intervening longitudinal lowlands characterizes the seaward margins of the Echigo Plain and other western plains of Ou as well. Scale about 1:40,000. See plate 29.

like lowlands, form the widest belt of wave and wind deposited materials along any of the western plains of Ou. The outer ridges are often dune capped, fence-like windbreaks being necessary in places to prevent the drifting of sand. Large areas are left in trees, which vegetation performs the dual service of anchoring the loose sand as well as protecting the settlements from strong sea winds. A distinctly linear arrangement of culture prevails, rice with some Japanese-pear orchards, occupy-

ing the wet parallel lowlands, while the intervening sandy ridges, where not in woods, are the sites for villages and dry crops, vegetables, especially sand-tolerant ones, such as melons, legumes, and tubers, being conspicuous. On the ocean side of the last ridge the wide expanse of sloping beach is also in vegetables. In contrast to the more northern Japan-Sea Plains, less snowy Echigo has an appreciable acreage of fall-sown wheat and barley occupying its unirrigated fields during the cool season.

The settlements of this coastal subdivision bear the earmarks of poverty. Often they are only a collection of hovels without well defined streets, completely hedged in by walls of bamboo trees. Compact villages are by no means absent, however. Where there is less protection from strong winds stone-weighted roofs are common. In many villages, and among the vegetable patches, wells with great wooden sweeps are conspicuous, reflecting the necessity for artificial watering in these arid soils.

On the poorly drained lowland back of the beach ridges is one of the greatest rice areas of Japan. Because of the wet nature of the plain, yields are high although the grain is somewhat soft and not of the highest quality.[32] Along the field margins, rows of bare poles or small trees with only tufts of foliage at their tops, serve as supports upon which can be hung bundles of grain or straw to dry. An early maturing, glutinous type of rice, called "mochi", used in pastry manufacture, is extensively planted, and the ripening fields of this variety were conspicuous by reason of their yellowish color when I was on the plain in early August. Low isolated beachridge remnants rise slightly above the alluvium in places and these dry sites become islands of upland crops in the midst of paddies. Irregularities, representing abandoned stream courses, as well as riparian belts of variable width along the present diked streams, similarly are sites for unirrigated crops. In the vicinity of villages, small artificially elevated plots of vegetables, fruit and mulberry are conspicuous.

Compact villages, many of them small and tree enclosed, are

[32] Takekoshi (Vol I, p. 25) speaks of a special rice plant, Koshi-tane, which is characteristic of western Ou. It is an early maturing variety particularly suited to the marshy and deep mud-fields of Echigo.

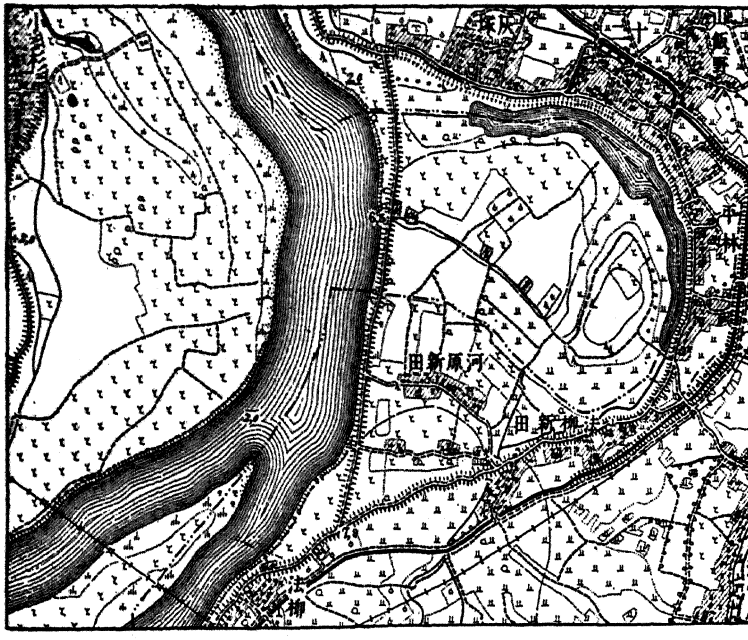


FIG. 28.—A section of the Echigo or Niigata Plain showing a conspicious riverine belt, somewhat elevated. Dikes and meander scars are prominent features. Settlements occupy the elevated crescentic dike along the ox-bow lake. Dry crops, especially mulberry, are prominent. Scale 1:50,000. See plate 16.

the prevailing settlement form on the new alluvium. "Strassendorf" types are especially common, paralleling highways on the wet plains and occupying dry sites along the dikes of streams, relict levees, and the low remnants of beach-ridges. What with the numerous villages, often protected by hedges and trees, and the rows of trees along rivers, canals, and even some field boundaries, the plain lacks extensive vistas and has a cluttered appearance.

Niigata City (125,000), near the mouth of the Shinanogawa, and occupying both sides of the river, is located in the midst of the beach ridges. Canals and bridges are numerous. Its hinterland is not only the immediate Echigo Plain, the largest in northern Japan, but includes as well the adjacent productive Tertiary hill country and the northern grabens of Fossa Magna. Most conspicuous among the city's industrial plants is an oil refinery and its storage tanks, for Niigata is the outlet for the nearby Echigo oil fields. Associated with this same mining in-

dustry are the repair shops for the oilfield machinery and equipment. On a silting river mouth, exposed to serious floods and to strong winter winds, Niigata is seriously handicapped in ocean shipping although it is nevertheless the ranking port of western Ou. Large boats lie at anchor in the open roadstead and discharge by lighters while small ones enter the river. In winter the larger vessels avoid Niigata and use instead the supplementary port of Yebisu on Sado Island. The principal exports are rice and petroleum. What little foreign trade there is, takes place with China and Manchuria, bean-cake fertilizer being outstanding.

6e. TAKATA PLAIN.—Although much less extensive, the Takata Plain in most respects closely resembles Echigo, its larger northern neighbor. Not so much along the coast, but interior, as the lowland narrows toward the mountains, snows are excessively heavy. Observation, corroborated by Japanese testimony, indicates that this is the approximate southern limit of the "gangi" or covered winter sidewalks, Naoetsu (58,000) is a minor port of call for coastwise steamers, exporting considerable oil produced in the adjacent Tertiary hills, and importing not only for the immediate plain, but for the northern basins of Fossa Magna as well.

C. CHUBU

Chubu includes that rugged, highest, and broadest part of Honshu where the mountain systems of north and south Japan coalesce to form a confused highland mass largely lacking in order and symmetry. Through the center of this mountain knot, in a N.N.W.-S.S.E. direction, and extending from coast to coast, runs a great transverse tectonic depression, the Fossa Magna, partially filled with recent volcanics and other young sedimentary rocks, but containing a series of detritus-choked fault valleys. Along the Hokuroku or Japan Sea coast, on either side of Noto Peninsula are the alluvial piedmont plains of Toyama and Kanazawa. The Tokai or Pacific side has three conspicuous bays of fault origin, Ise, Suruga and Sagami-Tokyo, the heads of the first and last named having alluvial lowlands, the Nobi and Kwanto plains respectively. At the head of Suruga Bay the great volcanic piles of Fuji and Ashitaka come down almost to the sea margins. The Sun-en coastal strip (excluding Izu Peninsula) between Kwanto on the north and Nobi to the south, is characterized by numerous small delta plains and conspicuous diluvial terraces separated from each other by spurs of hill-land.

Lowland Chubu is definitely within that part of Japan (south of 37°) where typical humid sub-tropical climates (Cfa) prevail. Abundant rainfall, long hot summers, a frost-free season of 180-260 days, mild winters with minimum temperatures in January a few degrees above or below freezing—such are the general characteristics. Lowland Chubu marks the approximate poleward limit of the sub-tropical broad-leafed evergreen woodlands and red-earth soils, although at higher elevations deciduous and mixed forests, typical of northern Honshu, prevail. Precipitation is heaviest along the Japan Sea coast (80-100 in.), accent being upon the winter months when dark overcast skies and heavy snows, like those of western Ou, prevail. Precipitation is somewhat less (60-80 in.) on the Pacific side, and the warm season is accented, with mid-summer being somewhat drier than either early summer or fall. Here winters have only

one third to one fourth the precipitation typical of the northwest coast, and while snow falls on 13-20 days, a permanent snow cover is lacking. The Sun-en coastal strip, narrow and protected on the north and west by broad and high mountain masses, has milder winters than the extensive and more exposed plains of Kwanto and Nobi at its northeastern and southwestern extremities. Within the mountain core, the graben basins of Fossa Magna have a variety of local climates but on the whole their temperatures are lower, frost-free seasons shorter, and rainfalls less, than on either of the coasts. In fact the 40-50 inches of precipitation, with a summer maximum, typical of these interior basins, gives them the distinction, along with parts of Hokkaido and the Inland Sea depression, of being the least rainy sections of Japan.

In occupance characteristics, Chubu as a region is less distinctive than either Hokkaido or Ou, for it is merely the northern and eastern part of long-settled southwestern Japan, where those landscape features commonly considered to be typical of Nippon (dense population, flimsy houses, tea, silk, tiny farms, multiple cropping, terraced hill-slope fields) are well developed. It has some distinction in that it includes the country's largest plain, Kwanto, and coincident with it and the Nobi lowland, two of the three largest compact population clusters in Nippon and three of its six great urban centers. Chubu's Pacific margins form the northern end of Japan's manufactural belt, including such industrial metropolitan centers as Nagoya, Tokyo, and Yokohama, the latter being as well one of the country's two greatest ports. The Sun-en coastal strip connecting the Tokyo-Yokohama industrial center with the Nagoya and Osaka-Kobe-Kyoto centers farther to the southwest, has the finest rail service in Japan, its traffic, both freight and passenger, exceeding that of any other section. Tea growing reaches its maximum development on the Pacific side of Chubu as does mulberry cultivation, for in the graben basins of Fossa Magna and on the Kwanto and Nobi Plains, the country's silk industry is markedly concentrated. In the neighborhood of 55 per cent of Japan's mulberry acreage is included within Chubu.

In contrast to the Tokai or Pacific side of Chubu, the Hokuroku littoral facing Asia is a less modernized, more provincial

region, where life moves at a slower pace and at a somewhat lower level as well. It is often designated as the "back-door" of Japan. No great urban centers have developed, large port cities do not exist, manufacturing is meagerly developed, commercial crops, other than rice, are few, foreign trade is insignificant, and in winter heavy snows, poor visibility and stormy seas offer serious handicaps to both land and sea transport. Snow sheds are very conspicuous features along all of the rail lines.[33]

Subdivisions of Chubu

Region 1. The Central Mountain Knot

Three principal subdivisions of the broad mountain belt of Central Honshu are here recognized, viz.; (1) the great transverse tectonic depression with its volcanic piles and graben valleys; and the mountain masses, (2) to the east, and (3) to the west, of the depression.

1a. The Transverse Tectonic Depression or Fossa Magna.—Geologically and morphologically the Fossa Magna stands as the zone of division between north-east and south-west Japan. The western margin of the trough is marked by a tremendous fault scarp, at or near whose base is a series of four graben basins. The eastern margin is less abrupt and distinct but is likewise marked by fault scarps with two grabens adjacent to the foot.

1a[1]. *The Hill and Mountain Masses of Fossa Magna.*—(1)*Izu Peninsula.*—Forming the eastern margin of Suruga Bay, which is the southern extension of the depressed zone of Fossa Magna, Izu Peninsula is a rugged hilly and mountainous country composed largely of andesite rock with conspicuous volcanic cones and lava flows. Slight subsidence has resulted in numerous small coastal identations at whose apexes are diminutive delta-plains, well cultivated, and furnishing sites for small agricultural-fishing villages. Other than the coastal margins the principal focus of occupance is in the meridional lowland which closely follows the axis of the peninsula where weak Tertiary

[33] Settlement forms and house types of Chubu are briefly dealt with in Volume 6 of, *An Encyclopedia of Japanese Geography*, p. 264-289 (in Japanese).

rocks are prevalent. Dispersed agricultural settlement appears to predominate. At the northern extremity of Izu, the hill slopes overlooking both Sagami and Suruga Bays are devoted in a specialized way to Satsuma orange culture, this being the northern limit of citrus cultivation in Nippon.

Associated with the recent volcanic activity of the region are the numerous hot mineral springs, which, together with the general scenic beauty, have been responsible for the establishment of frequent spas and resorts, well known to foreigners as well as Japanese. Miyanoshita Spa in the Hakone district is the most famous.[34] The volcanic mass of Mt. Hakone interposes the most serious barrier to land transport along the Tokkaido route. During the Tokugawa regime the pass over this mountain was guarded by a great gate and from that originated the geographical terms, "Kwanto" (Tokyo-Yokohama region) meaning "east of the gate", and "Kwansai," (Osaka-Kyoto region) "west of the gate". Even yet continuous toll is still paid to the mountain for the double tracked Tokkaido railway, bearing as it does the heaviest traffic within the country, crosses the barrier by a circuitous route replete with steep grades and numerous tunnels.[35]

(2) *Mt. Fuji.*—Occupying the heads of most of the large bays along the southeast coast are important aggradational plains. Suruga Bay on the contrary is terminated at its landward end by the symmetrical cone of Fujiyama and its lower, eroded satellite, Ashitaka. The comparatively smooth interstream uplands of their lower ash aprons are partially under cultivation, tea and mulberry as well as the usual summer and winter annuals being conspicuous. Numerous small hydro-electric plants occupy sites in the relatively steep-gradient valleys along their eastern and western flanks, providing power for important manufacturing plants.[36] To the north of Fujiyama and occupying portions of a semi-circular trough between the flanks of that volcano and the Tertiary mountains are the five lovely Fuji lakes.[37] Numerous small villages occupy the trough, most

[34] Guide-Book Excursion B-2—Hakone. Pan-Pacific Science Congress, Japan, 1926.
[35] A long tunnel is at present under construction to the south of Mt. Hakone between Atami and Mishima, which will shorten the route across this barrier by 48 km.
[36] See Glenn T. Trewartha: A Geographic Study in Shizuoka Prefecture, Japan, *Annals of the Asso. of Amer. Geog.*; Vol. XVIII, Sept., 1928, pp. 127-259 (156-170).
[37] Guide-Book Excursion B-4—The Lake District around Mt. Fuji. Pan-Pacific Science Congress, Japan, 1926.

of them specialized in silk reeling. Maize is locally significant and in October when I visited the area yellow ears of corn hanging under the wide eaves of the houses were a common sight. Crops occupy lacustrine plain and fan sites as well as the lower ash uplands.

(3) *The Tertiary Mountains.*—Encircling Fuji on the west, north and east is a semi-circular belt of mountains which is unlike many regions of Tertiary rocks in that it is a relatively high and rugged mountain mass with maximum elevations of 1200-1900 meters. Occupance is meager.

(4) *Yatsu and* (5) *Myoko Volcanic Groups.*—Midway across Honshu in the Fossa Magna depressed zone is the Yatsu volcanic cluster, while farther north beyond Nagano city is the Myoko group. The former consists of four large cones, the principal one being 2,899 meters high, while three large conical volcanoes and several smaller ones comprise the northern aggregation. Throughout both, wild and rugged country prevails and inhabitants are rare except along the lower margins adjacent to the graben basins.

(6) *The Northern Tertiary Hills.*—Occupying the northern part of the depressed zone, this unit comprises a well dissected hill country with considerable areas of moderate slope and valley-bottom land, so that cultivation is relatively widespread as well as intricate in pattern. Dispersed settlement is common. Mulberry is outstandingly important, for this region is a part of the central Honshu specialized sericulture region.

1a^2. *The Fault Basins of Fossa Magna.*[38]—These intermontane grabens of 250-700 meters elevation, drier and cooler than the coastal lowlands, have many natural and man-induced features in common. A distinctive characteristic common to them all is the large amount of alluvial and diluvial piedmont material, often coarse in texture and steep of slope, which occupies much of their areas. Varying amounts of this detritus are diluvium, carved by streams into terraces at various levels, but fan and cone configuration are conspicuous in both recent and old deposits. Soil materials are inclined to be coarse or even

[38] For a more detailed study of a representative basin, see—Glenn T. Trewartha; The Suwa Basin: A Specialized Sericulture District in the Japanese Alps, *Geog. Rev.* XX, No. 2, 1930, 224-244.

stony, which feature in conjunction with the sloping piedmont surfaces, cooler shorter summers, and less rainfall, somewhat handicaps rice cultivation but by no means excludes it. On some of the fans paddies are artificially terraced, their outer retaining walls being composed of smooth water-worn boulders which are present in abundance. Normally the rice fields produce only one crop, although many of the dry upland fields are planted to wheat and barley in autumn. But of outstanding importance is the mulberry crop, for these mountain basins of Fossa Magna are the very heart of Japan's silk-producing region. In not a few of the villages (referring here to an areal political unit and not a settlement) mulberry occupies 40-60 per cent of the cultivated land. Mountainous Nagano Prefecture in which all but one of these grabens are located, is easily the ranking prefecture in Nippon in sericulture, having 11 per cent of the country's mulberry acreage, producing 12-13 per cent of its cocoons, and reeling 23-24 per cent of its raw silk.[39]

Over Japan as a whole the rearing of silk worms is auxiliary to general farming. In these basins of central Honshu it is more frequently the chief and even overshadowing occupation. This specialization in sericulture and regional concentration of silk production, reflects in part the relative inaccessibility of the region and the predominance of slope land, the effects of which have been previously analyzed. The two most common mulberry locations are; (1) a zone several hundred feet wide along the foothills of the bordering mountains, and (2) the higher and stonier parts of fans where irrigation is difficult. Because of the shorter growing season[40] in these high altitude basins an early-budding, quick-maturing, dwarf variety of bush is grown, which yields less per unit area and from which only one picking is possible. At these altitudes late spring frosts are a genuine hazard to mulberry so that in the region there is emphasis upon summer and autumn worms rather than upon the spring crop which is more important for the country as a whole.

These interior basins of Chubu, like those of Ou, are very

[39] The Seventh Statistical Volume of the Ministry of Agriculture and Forestry (in Japanese) published by the Section of Statistics, Ministry of Agriculture and Forestry, Japan, 1932. The discrepancy between mulberry and cocoon percentages on the one hand as compared with raw silk on the other, reflects an import into the reeling centers of Nagano of cocoons from other parts of the country.

[40] The growing season is just slightly over 5 months at Matsumoto as compared with 7 months and 8 days at Tokyo near sea level.

conspicuous on a popuation map, because of their dense settlement, standing out in contrast to the meagerly inhabited surrounding highlands. Because of its depressed nature, Fossa Magna and its basins are not only a region of important population concentration but likewise a significant transit route between the opposite coasts. No single rail line follows the depressed zone throughout its entire length although both the eastern and western grabens are served by lines focusing upon Tokyo, the eastern one reaching Takata and Niigata on the Japan-Sea Coast. Rail connection is also made by way of the Kiso valley with Nagoya, and beyond that with the whole Kinki region, but ties are strongest with the Kwanto cities so that these basins become an important part of Yokohama's hinterland for silk export.

Village type of settlement on the whole predominates although isolated farmsteads are not uncommon especially on the fans and terrace surfaces. Certain culture forms associated with the silk industry are conspicuous in many of the settlements. Even from a distance the tall iron smokestacks of the filatures are obvious; closer scrutiny brings into view the low unimpressive, shed-like reeling plants and the huge barracks-like cocoon warehouses, 3-6 stories high, with batteries of windows, protected by wide eaves, marking each story. Because of the cheap and flimsy construction of the filatures, containing no provision for heating in cold weather, these plants are usually closed during the two or three winter months.

(1) *Matsumoto Basin* is the northernmost of the genuine basins lying at the foot of the western fault scarp which bounds the Fossa Magna, although the very narrow Himekawa rift valley extends on to the north coast. Features of the Matsumato Graben do not depart greatly from the representative conditions previously described. Alluvial and diluvial fans and terraces are conspicuous features. The metropolis (72,000), after which the basin has been named, is a castle town having present-day fame as center of the silk industry in its various phases.

(2) *Suwa Basin,* next to the south, its center being occupied by a lake, with alluvial piedmont margins, has distinction in that it is the single greatest filature center in Japan, most of the plants being located at Okaya, the metropolis. The explanation

of this concentration in Suwa has its roots in the past.[41] Lying between the cotton-producing plains along the Pacific Coast and the non-cotton producing west and northwest, at a natural sag in the dividing range and near the heads of a number of radial valleys which ascend from the Pacific coast, the Suwa region after the middle of the 18th century became a relaying, distributing and cleaning center for this fiber. After the opening of

FIG. 29.—A steep alluvial fan in Suwa Basin. Mulberry occupies the steeper stonier upper part and rice the lower sections. (Plate loaned by the Geographical Review published by the American Geographical Society of New York.) See plate 34.

Japan to world trade (1853) cotton was imported instead of grown locally and Suwa, losing its position as a cotton distributing and processing center, gradually turned to another

[41] See, Trewartha: The Suwa Basin, *op. cit.*, p. 238-239; also, Katsue Mizawa: The History of the Suwa Silk Industry, from the Geographical Viewpoint, (in Japanese) *Geographical Review of Japan*, Vol. 2, No. 10, Oct. 1928.

fiber, raw silk. Within Okaya there is a marked concentration of filatures along the Tenryu River, where before the development of hydro-electricity, direct water power was obtained from the stream. Kamisuwa, a castle town located on the lake,

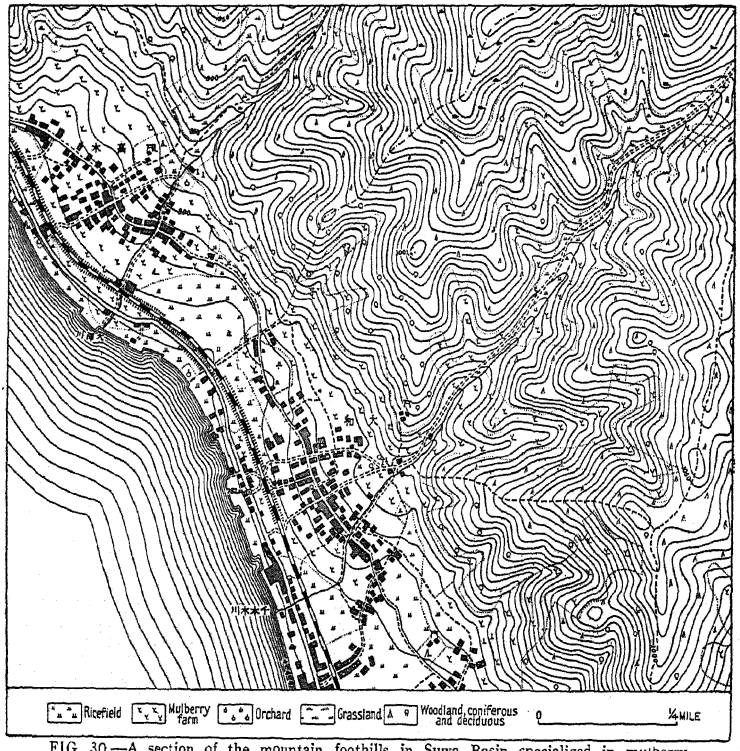


FIG. 30.—A section of the mountain foothills in Suwa Basin specialized in mulberry growing. (Plate loaned by the Geographical Review published by the American Geographical Society of New York.) See plate 35.

has fame as a resort center and boasts of several excellent inns. Hot sulphur springs, skiing and skating facilities in winter, and the general scenic effect of lake and mountains, all combine to make the place attractive.

(3) *Kofu Basin*,[42] next to the south, is separated from Suwa by the Yatsu volcanic group so that the connection between the two grabens is reduced to a relatively constricted

[42] S. Kowada: Some Geographical Considerations concerning Kofu Basin (in Japanese) *Geog. Rev. of Japan*, Vol. VII, No. 12, 1931, pp. 19-31. K. Tanaka: The Kofu Basin, *Geog. Rev. of Japan*, Vol. I, 1925, pp. 975-946, and Vol. II, 1926, pp. 17-46.

valley. But on the ash slopes and river terraces there is sufficient settlement so that the corridor is evident on a population map. Kofu, the most southern and least elevated of the grabens, is warmer, less frosty and snowy than the others.[43] Besides its specialization in sericulture the basin has some fame as a grape growing district. Kofu City (79,000), a castle town, is an important cocoon market as well as a filature center.

(4) *Nagano and* (5) *Ueda Basins.*—Along the eastern margins of the transverse depression at the foot of less conspicuous fault scarps, is a north-south corridor constricted to valley dimensions in places but containing two wider basin-like sections designated as the *Nagano Basin* to the north and the *Ueda Basin* farther south. Both regions are thoroughly specialized in the various phases of raw silk production. Nagano City, (74,000,) contains one of the most famous Buddhist temples of Japan and is something of a Mecca for religious pilgrims.

1b. THE HIGHLANDS EAST OF FOSSA MAGNA.—In this region of confused and formidable mountain country where the three distinct and parallel highland chains of northern Honshu fuse, it is less easy to distinguish individual mountain areas.

1b[1] *Nasu Volcanic Chain.* Crescentic in shape, with its convex side toward the southeast, this range, composed of numerous volcanoes of various types and ages, is for the most part meagerly occupied. Some tillage is carried on not only in the restricted valleys, but on the lower slopes of a number of the smoother ash aprons as well. Mulberry is especially noteworthy. At the southwestern extremity of the range, under the shadow of active Mt. Asama, is the city of Karuizawa, famous throughout Japan as a summer hill-station (3,180 feet) for occidentals. Nikko, a town containing the most magnificent aggregation of colorful and ornate Buddhist temples, mausolea and pagodas to be found anywhere in Japan, and set in the midst of noble cryptomeria groves, is located on the western flanks of the Nasu Range. Reflecting the gorgeousness of the buildings and their wooded setting, there is a Japanese expression, "Until you have seen Nikko, do not say splendid." Excellent accommoda-

[43] Kofu has only 11.7 snowy days on the average as compared with Matsumoto's 46.5 and Nagano's 82. The growing season is 194 days at Kofu while at Matsumoto and Nagano it is 157 and 167 respectively.

tions for foreigners and natives alike cater to the throngs of sightseers who visit this Japanese Mecca.

1b[2] *Chichibu and,* 1b[3], *Ashio Mountains,* although separated by the Tone lowland which forms the western arm of the Kwanto Plain, are similar geologically and greatly resemble the Outer Zone of Southwest Japan, being composed of ancient, folded sedimentary rocks faulted and tilted so that block form is the result. In general the Chichibu Mountains present a rugged landscape with some peaks of over 2500 m. elevation, so that occupance is meager. Certain small areas of weak Tertiary rocks, as for instance the Chichibu Basin, where relief is much less and valleys more open, are exceptions to the rule, for in these locations a relatively dense dispersed type of settlement is characteristic.

The Ashio block with its back slope toward the Kwanto plain is less high (highest elevation 1526 m.), and its valleys much wider and better occupied. Along igneous intrusions at the northern boundary is one of Japan's largest copper deposits, the Ashio mine,[44] employing 3,840 laborers and producing in 1930 copper valued at 8,600,000 yen (one-sixth to one-fifth the nation's output) and silver and gold worth over 500,000 yen.[45]

1b[4],*Boso and,* 1b[5], *Miura Peninsulas.*—These remnants of an old east-west horst, the fracture and partial subsidence of which resulted in Tokyo Bay and Uraga Channel, have rather typical Tertiary landscapes. Elevations are usually under 400 meters. Dissection is mature and isolated farmsteads and cultivated lands occupy both the labyrinthine valleys and the lower hill slopes. Minor sinking has produced an irregular coastline with numerous small cultivated deltas at the heads of indentations, upon whose seaward margins are characteristic agricultural-fishing villages. Misaki, at the extreme southern extremity of Miura, has considerable fame as a fishing port. Wave cut platforms and sea cliffs are conspicuous features of the Tertiary headlands. At the narrow entrance to Tokyo Bay and guarding this greatest population unit of Japan on the Kwanto Plain, is the fortified city of Yokosuka.

[44] Guide-Book Excursion C-1; The Ashio Copper Mine. Pan-Pacific Science Congress, Japan 1926.
[45] *Trends of Mining in Japan,* 1930, English Appendix.

1c. THE HIGHLANDS WEST OF FOSSA MAGNA.—1c[1] *Hida Highlands.*—The easternmost part of Hida, where it terminates abruptly in a fault scarp overlooking Fossa Magna, is the highest range in Japan (some parts over 3,000 m.), often designated as the Japanese Alps. At the present time no glaciers exist although there are cirque-like features. Numerous volcanoes, some of them very youthful in appearance, cap the range. Occupance is extremely meager. Where the Hida mountains reach the Japan Sea they terminate abruptly in formidable sea cliffs.

Westward from the fault scarp overlooking Fossa Magna, altitudes decline, and a broad area of rugged hill country, with elevations in general under 1,000 m. prevails. But valleys are still narrow, and waste-filled basins are largely absent, so that the agricultural population is meager. From the standpoint of occupance features this is one of the most empty regions in Old Japan. Mining of copper, lead, zinc and silver, usually on a small scale, is characteristic of a number of localities, only one mine having an annual output approaching 2,000,000 yen. Here and there in the isolated and inaccessible valleys of Hida are still to be observed that now relatively rare feature, the large patriarchal-family house. These relict forms are probably most numerous in the Nakakiri district of Gifu Prefecture, almost due south of the Toyama plain. The dimensions of a representative large house in this locality are given as 78 ft. x 48 ft. with a height of 46 ft., which allows for 4 to 5 stories. Such a house accommodated 40 to 50 or more persons although at present there are few with more than 20 residents.[46]

1c[2] *The Tertiary Hill Country.*—Intermediate in elevation between the plains on its seaward margins and the Hida Highlands to the rear, this belt of Tertiary hills has a fairly representative landscape for such regions of weak rocks. Rice is grown both on the valley floors and on some of the milder slopes as well. Artificial irrigation ponds are numerous. The Noto Peninsula which forms the principal irregularity of the northwest coast of Honshu is a low warped dome with, in places, faulted margins. A narrow graben valley, alluvial floored, divides the peninsula into a northern and a southern half. The indented coasts of Noto contain numerous fishing

[46] *An Encyclopedia of Japanese Geography*, Vol. 6, pp. 286-288, Vol. 6B, pp. 167-170 (in Japanese).

villages, as well as two important local ports, Fushiki and Nanao, which serve the adjacent plains whose smooth coasts provide no satisfactory natural harbors. Fushiki, at the very northwestern extremity of Toyama Plain where it makes contact with Noto, can accommodate boats of 3,000 tons at its quays. Its chief export is rice, reflecting the principal specialization of the adjacent Toyama Plain which is its principal hinterland. Coal from Hokkaido, beans and bean-cake from Manchuria and Vladivostok, and logs from Hokkaido and Sakhalin, comprise the chief imports. Its total trade, valued at 80,000,000 to 90,000,000 yen, of which only 7 or 8 per cent is with foreign countries, gives it first rank among the ports along the Japan-Sea coast of Honshu. Nanao, strategically located at the eastern end of Noto graben, and like Fushiki, under the protection of the peninsula, is connected by rail with Kanazawa and its productive hinterland, which region it serves as a port.

1c[3] *Kiso Mountains.*—Essentially a horst, this granitic mass of rugged mountains with elevations approaching 3,000 m., is sparsely occupied. River terraces in some of the larger valleys appear to be the principal agricultural sites. The single railroad reaching the basins of Fossa Magna from the Kinki district follows the canyon-like *Kiso Valley*, the route of once-famous Nakasendo Highway. Close to the eastern margin of the Kiso mountains is the detritus filled (1) *Ina Trench*, presenting a landscape, which in its major lineaments, is essentially like that of the grabens of Fossa Magna.

1c[4] *Akaishi Sphenoid.*—In its high relief, steep slopes and meager settlement, Akaishi closely duplicates Kiso. Similarly also it is a horst, but it differs in being a highly folded mass of sedimentary and metamorphic rocks instead of granite. Geologically it belongs to the folded mountains of the Outer Zone of Southwest Japan.

Region 2. Lowlands of the Hokuroku (Japan Sea)

Littoral of Chubu

2a. Toyama Alluvial Piedmont.—Among all the coastal lowlands of northwestern Honshu, Toyama, east of Noto Pen-

insula, is the exception. Three contrasts are conspicuous: (1) Unlike the others it is not a low, wet, filled lagoon, but on the contrary is composed of a series of relatively steep alluvial and diluvial fans forming a piedmont belt; (2) the usual wide belt of parallel beach ridges and dunes along the seaward margins is lacking; and (3) there is a most remarkable development of dispersed rural settlement.

Toyama is a bay-head plain partially occupying a depressed block lying between Noto Peninsula and Honshu proper. The lack of a marked belt of beach ridges and dunes along the outer

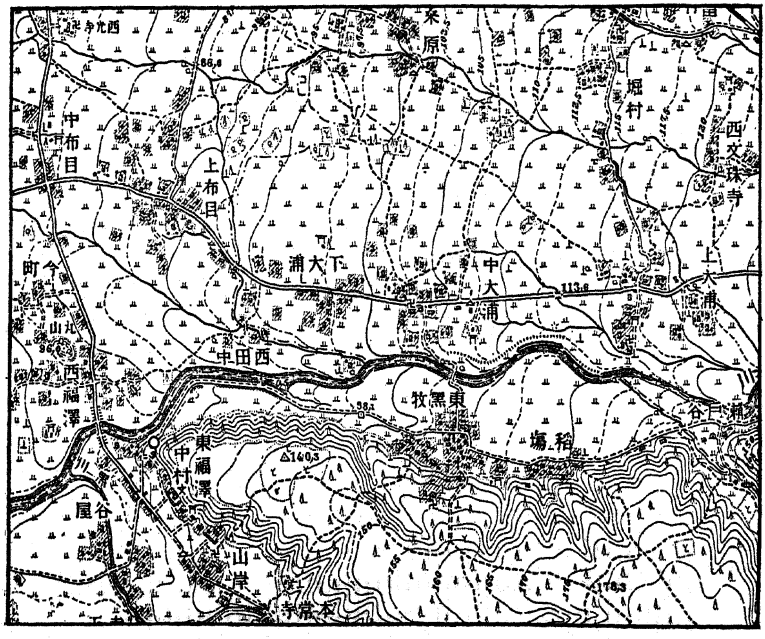


FIG. 31.—A section of the Toyama alluvial-diluvial piedmont showing dispersed and semidispersed settlements. A higher bench of the diluvium, in dry crops and trees, is conspicuous south of the river. Scale 1:25,000. See plate 33.

margins of the plain is due to; (1) the deep waters of Toyama Bay, and (2) a weakening of the usual strong winter waves and currents due to the protection offered by Noto Peninsula.[47] It is probable that the high Hida Range immediately to the rear of Toyama largely accounts for the well developed alluvial-

[47] Conversations with Mr. Harada, Geographer on the Normal School Faculty at Toyama.

diluvial piedmont belt.[48] Coarse diluvial sediments in the form of fans and benches at various levels, resting unconformably upon Tertiary prongs, characterize the inner margins of the plain. In places relatively broad and smooth depositional surfaces still persist; in others stream erosion has produced roughened surfaces. Conspicuous cliffs, providing excellent cross-sections of assorted fluvial materials, are not infrequent, but gradual transitions from one level to another are more common. Red loams, resulting from weathering of the diluvial sands and gravels, cover these older deposits.

The new fans, also composed of coarse stony materials, and resting upon eroded diluvium or upon Tertiary surfaces, merge, along their upper slopes, with the older formations without a very perceptible disconformity. Broad boulder-strewn stream courses, containing vigorous rivers occupy both fan-crest and inter-fan locations. Scars of old stream courses testify to river vagaries. Toward the sea margins, conspicuous crescentic arrangement of contours, characteristic of compound fans, gives way to a flattish plain.

On the steeper fans of Toyama the completely dispersed settlement type, with the individual isolated farmstead as the unit of occupance, is the rule.[49] This feature is most perfectly developed in the upper part of the western fans in the vicinity of Fukuno, where, other than a few relatively large market villages, the individual farmstead is the exclusive settlement form. There appears to be no system in the arrangement of the residences. Each house is hidden in a tall hedge of conifer trees which completely surrounds and protects it either against the sea winds or from foehns which arrive from the interior. From an elevated vantage point the fan appears to be dotted with tiny groves. In such regions of disseminated population peddlers often carry provisions from the market village to the rural farmstead. Gradually, as the fans flatten out upon approaching the sea there is a tendency for small agglomerations to become more prominent at the expense of isolated farmsteads, until finally on the flattish ocean margins of the lowland little villages are the

[48] A Watanabe: Consideration of the Elevated Delta-Fans of Japan, (in Japanese) *Geog. Rev. of Japan*, Jan. 1929, Vol. 5, No. 1, pp. 1-13.

[49] Isamu Matui: Statistical Study of the Distribution of Scattered Villages in Two Regions of the Tonami Plain, Toyama Prefecture, *Jap. Jour. of Geol. and Geog.* IX, Nos. 3 and 4, March 1932, pp. 251-266. (In Japanese). See valuable bibliography, p. 251.

rule. In most cases the residence-clusters, like the individual farmsteads, are hedge enclosed.

As noted earlier in the study, dispersed settlement in Japan is often indicative of relatively recent occupance. It is probable that retarded settlement of the steeper coarser parts of fans is associated with inhospitable site characteristics in the form of stony infertile soils and the hazards associated with vagrant rivers.[50] But here again Toyama seems to be the exception, for from a study of old maps Dr. Ogawa concludes that, rather than being indicative of recent occupance, the scattered rural residences here are relict features associated with the ancient "Iori" system of land division in which one cho (2.5 acres) was the common unit of land holding. It has become a tradition in the Toyama region that a farmer shall cultivate a single block of land, owned or perhaps partly rented, in the immediate vicinity of his dwelling. Dr. Ogawa further suggests that the prevalence of strong foehn winds descending from the Hida Range, and the consequent fire hazards which they induce, may be an additional reason for the persistence of isolated farm residences.[51]

The "gangi" or enclosed sidewalk is not known in this region, although the roofs of thatched houses are steeply pitched so that snow will not accumulate to a great depth. Tile and shingle roofs are less steep, their greater conductivity permitting the snow to melt off. Two cities, Toyama (75,000), a feudal castle town and the present political capital of the prefecture as well, and Takaoka (52,000), are the commercial centers. Toyama has some fame as a patent-medicine and textile manufacturing center. The smooth coastline of the plain offers little in the way of natural harbors so that the local port, Fushiki, previously described, occupies a river mouth site adjacent to the southeastern margins of Noto Peninsula.

More exclusively than the landforms would lead one to expect, rice is the dominant crop in the Toyama region, so much so that large amounts are exported to other parts of Japan. Not only on the lower flatter areas, but even on the higher parts of the fans and the crests of the diluvial terraces as well, paddies are conspicuous, although in the latter locations, mul-

[50] See Trewartha: A Geographic Study in Shizuoka Prefecture, Japan; Op. cit., pp. 241-244.

[51] *Encyclopedia of Japanese Geography*, Vol. 6B, p. 267.

berry, vegetables, and even woodland, offer competition. Only small amounts of wheat and barley are grown as winter crops. Stones are prominent on the fans, many of the farmsteads being surrounded by low walls of smooth water-worn boulders, while the retaining walls of the terraced paddies are similarly constructed. What with the numerous tree-enclosed, isolated farmsteads and small villages, as well as the frequent lines of trees along roads and waterways, the plain has a confused and cluttered appearance, wide vistas being absent.

2b. THE PLAINS WEST OF NOTO PENINSULA.—The relatively narrow strips of alluvium west of Noto Peninsula have more physical and cultural features in common with the plains of western Ou, than with Toyama. Essentially they are filled lagoons, still poorly drained in places, whose seaward margins unprotected by Noto Peninsula have wide belts of parallel beach ridges and dunes with smooth harborless coastlines. In places where fan configuration is conspicuous, lagoon features are absent and the belt of beach ridges is narrower. The vigorous winter winds and concomitant waves and currents of the Japan Sea littoral, not only produce conspicuous shore-line features, but result in such characteristic culture forms as dense windbreaks around settlements, boulder-covered house roofs, sand fences, and covered piles of kindling and firewood anchored securely to the ground. Small compact settlement units, tree enclosed, are most common. Back of the protective rows of conifers which cap the outermost of the beach ridges, the elevated sandy belt has considerable areas planted to unirrigated crops, especially vegetables and mulberry. Similar cropping practices are common on the fragments of diluvial terrace. On the poorly drained lagoon-plain rice almost monopolizes the cultivated land.

Kanazawa (157,000), the metropolis of this plain and of the entire west coast of Honshu as well, was for three centuries the feudal capital of one of the greatest and richest daimyos. Today it is the capital of Ishikawa Prefecture, headquarters of the ninth army division (located in the castle grounds) and center of an important silk weaving industry. Fukui (64,000) another castle town farther down the coast, is still more famous as a silk weaving center. The industry is not confined to these

two cities for the small weaving plants are found in numerous smaller towns as well, causing these lowlands west of Noto Peninsula to be the country's foremost producing region of silk cloth. This specialization in the fabricated product is not based upon a large scale cocoon production in the immediate hinterland but rather has its explanation in certain historical antecedents. Where the Saikawa river breaks through the dune barrier is the little river-mouth port of Kanaiwa, so shallow as to be of little value. Even coastwise ships cannot enter the harbor. In winter it is useless. Of much more importance is the port of Fushiki on Noto Peninsula with which the Kanazawa hinterland is connected by rail.

Region 3. Lowlands of the Tokai (Pacific) Coast of Chubu

3a. Kwanto or Tokyo Plain.—This largest lowland of Nippon, 2,500-2,700 square miles in area, is also coincident with the single greatest unit of compact settlement, over 10,000,000 persons residing on Kwanto in 1926, which was one sixth of the nation's population. It is composed of unconsolidated fluvial, estuarine and marine deposits in alternating clay, sand, and gravel strata, totaling several hundred meters in thickness, occupying a tectonic depression. Overlying the waterlaid sediments are several meters of subaerially or shallow-water deposited volcanic ash. To within recent geological times the southern margin of the Kwanto depression was a continuous horst composed of Tertiary rocks, Tokyo Bay being a recent subsidence area.

Emergence of the sediments has not been symmetrical for the plain gradually increases in elevation from the center, where it is scarcely 20 meters high, to elevations of 30 to 50 meters along the seaward margins, and to still greater heights toward the west where fan configuration is conspicuous. Valley profiles show steep terraces indicating haltings during emergence. Rivers have incised broad valleys into the uplifted diluvial sediments, later depression of the land transforming them into estuaries which have been subsequently filled. Nevertheless, long estuarine remnants of swamp and lake still persist along the lower stream courses. The most recent crustal movement,

slight uplift, has produced narrow belts of new coastal plain with smooth coastlines along the sea margins. These coastal strips are bordered on their land sides by wave-cut diluvial cliffs or headlands, which features, turning inland along the rivers, form the margins of the floodplains. Generally speaking, Kwanto is a relatively uniform plane-surface ending in more or less continuous steep bluffs along the river valleys and the narrow coastal strips. Only along these steep bluffs is the ash cover so thin as to expose the diluvial beds of sand and gravel. The peculiar double-crescent configuration of the eastern coast is the result of a hard rock sill forming the projecting point known as Cape Inumo.

In spite of active stream erosion, ash covered diluvial terrace, 20 to 50 meters above sea level, still covers the larger part of Kwanto, this most extensive plain being distinctive among Japanese lowlands in that it is so predominantly of old rather than of new alluvium. Japanese geographers recognize two general terrace levels separated from each other by a line of dislocation, (1) the higher Tama, and (2) the lower Musashino, terraces. The latter covers much the larger part of the plain and consists of wide series of smooth tabular surfaces, lying between broad, shallow, alluvial-filled valleys. Toward the mountain borders on the north and west the gradients steepen perceptibly and take on fan-like configuration although the surfaces remain comparatively smooth. West of Toyko Bay and south of the Tama River which lies nearly midway between Tokyo and Yokohama are remnants of the higher terrace (Tama) whose altitudes approach 200 meters at the foot of the Kwanto Mountains, but descend eastward to about 30 meters along the ocean margins. Smaller erosion buttes known as the Sayama and Asayama Hills, resembling the Tama terrace, rise above the general low-terrace level north of the Tama River. In general these higher terraces are maturely dissected and lack extensive smooth summit areas which is the principal feature distinguishing them from the Musashino levels.[52] This higher

[52] 1. Fossil-Localities in the Environs of Kioroshi, Guide-Book Excursion C-6 Pan-Pacific Science Congress, Tokyo, 1926.
2. Kamakura and Enoshima—Guide-Book Excursion C-5. Pan-Pacific Science Congress, Tokyo, 1926.
3. H. Yabe: Geological Growth of the Tokyo Bay, *Bull. of the Earthquake Research Institute*, Tokyo Imperial University, IX (1931) Part 3, pp. 333-339.
4. H. Yabe, H. and R. Aoki: The great Kwanto Earthquake of September 1, 1923, Geologically Considered, *Annual Report of Saito Gratitude Foundation, Sendai, Japan.* No. 1, May 1926, pp. 70-83.

Tama upland reaches the sea in the vicinity of Yokohama, where it terminates in precipitous cliffs.

Five contrasting landform types of Kwanto have been recognized; (1) the low Musashino terraces; (2) the broad, shallow alluvial-filled stream valleys, often with cliffed margins; (3) the higher and more dissected Tama terraces; (4) diluvial fans at the base of the mountains, and (5) narrow belts of new coastal plain along the seaward margins of the plain.

Excepting the immature new alluvium, the soils of Kwanto are derived from weathered volcanic ash which mantles the diluvial sediments. They are emphatically ruddy in color except perhaps for a humus-impregnated veneer; vary in texture from loams to clays, and are relatively infertile, being leached of the soluble plant foods. Virgin ash soils yield only low returns. Because of the presence of active colloidal substance they are able to imbibe and retain large amounts of water which in years of excessive rainfall makes them wet and soggy even to the point of injuring crops.[53]

Considering the long period of Japanese history the occupance of Kwanto has been both recent and relatively slow. When Japanese culture had attained its height ten centuries ago in Nara and Kyoto, old national capitals in the Kinki region, Kwanto was still in large part a wilderness known as Musashino. It was not until the latter part of the sixteenth century, when Yedo (Tokyo) was made the residence of the ruling Tokugawa shoguns that development of the adjacent lowland was markedly accelerated. The retarded settlement of this largest plain of Nippon is associated with the predominance of infertile, ash-covered diluvial upland, whose soil and relief characteristics are not well suited to irrigated rice. Even today, although Kwanto, because it is the largest lowland, is coincident with the single greatest population cluster in Japan, the general density of settlement is probably not more than one-half as great as that of other important plains along the Pacific coast which are predominantly of low, fertile, easily-irrigated new alluvium. Large areas of the flattish diluvial uplands still bear a woodland or wild-grass cover.

[53] Dr. T. Seki: Distribution of Volcanic Ash Loams in Japan Proper and Their Characteristics and Agricultural Value; *Proceedings of the Third Pan-Pacific Science Congress*, Tokyo, 1926, pp. 1936-1941.

The Rural Landscapes of Kwanto.—Low and high-level occupance, as illustrated by the differentiated land-use of low floodplains and higher terraces, is distinctive of Kwanto. It is on the low, easily-irrigated flood plains and deltas with their superior soils, that the highest population densities are found and in such locations on Kwanto the ratio of persons to area is similar to that of the other crowded lowlands (350-1,000 per sq. km.). It is the western half of Kwanto therefore, which contains the larger share of new alluvium, and particularly on a belt extending in a northwesterly direction from Tokyo along the complicated floodplain nets of the Tonegawa, Nakagawa and a number of other closely spaced rivers, that crowding is most marked. Settlements on the alluvium tend to be compact units, with the villages of the floodplains located, (1) adjacent to, or even on, the lower margins of the diluvial slopes, where drainage is superior and proximity to both irrigated and upland fields is an advantage; or (2), on similar dry sites along river levees or highways. These low-level floodplain locations, except for the higher riverine belts, are devoted largely to irrigated rice, the drainage lines standing out clearly on a culture map showing paddy lands. In the periurban belt adjacent to Tokyo, elevated vegetable plots among the rice fields are common. Most of the paddy land remains fallow, or has only a crop of genge, (a leguminous green manure) during the cool season. In some of the recently reclaimed lands along the seaward margins of the larger deltas, polder landscapes are characteristic with the master dikes enclosing relatively large areas devoted exclusively to rice. Where drainage is relatively imperfect, "strassendorf" settlements occupy dike sites. Where it is drier, the grid pattern of roads and the isolated farmsteads remind one of Hokkaido.

On the smooth (not necessarily level) surfaces of the younger terraces, representing high-level occupance, dispersed and semidispersed, as well as compact settlement, is common. A characteristic and oft-repeated belted culture pattern in the mulberry section is as follows: a long "strassendorf" or "einwegdorf" settlement straddling a main highway, the village in turn paralleled by linear belts of mulberry and beyond these fields of annuals and then woods or wasteland. This belted arrangement, with the mulberry closest to the village, makes it

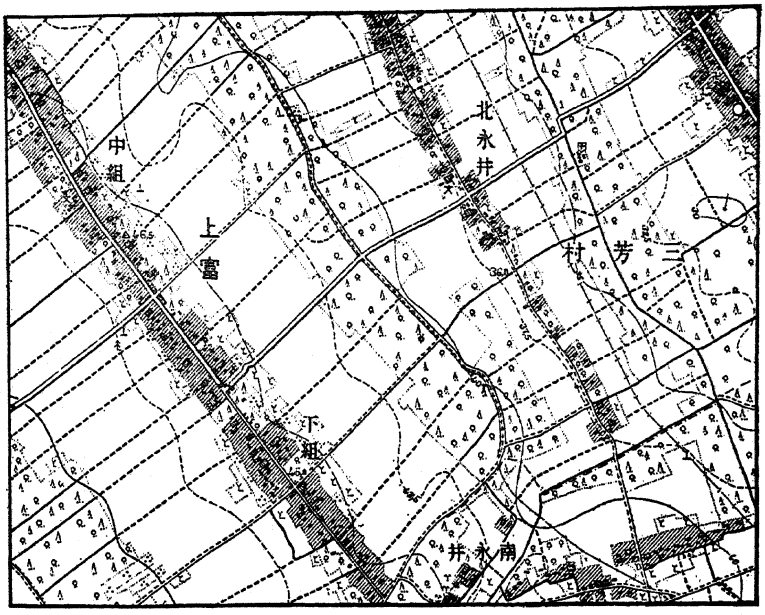


FIG. 32.—A section of the lower or Musashino terrace of Kwanto. Two shoestring settlements bordering highways are conspicuous. Mulberry is an important crop adjacent to the residences, while other dry crops form wider belts beyond. These in turn, at some distance from the village, are limited by belts of woodland. This culture pattern is repeated for numerous villages on Kwanto. Scale 1:25,000.

relatively easy to get bulky fresh green leaves to the silk worms which are reared in the farm residences.[54]

As stated earlier in the discussion of Kwanto, large areas of the flattish uplands are not in crops but are in planted woodlands or left in moor-like wastes. Paddy fields are not common. Large areas of cultivated upland are devoted to summer crops of vegetables, beans, peas, sweet potatoes, millet and buckwheat, and these in turn followed by autumn-sown wheat and barley. The steep margins of the terraces where wash would be dangerous, prevailingly carry a woodland cover. Thus airplane views of Kwanto characteristically show the irregular paddy landscape of the floodplain separated from the somewhat coarser and more rectangular dry-field layout on the diluvium by a narrow sinuous belt of darker woodland, marking the steep winding terrace margins. In central and northern Kwanto is the largest specialized tobacco area of the country. Tea gardens likewise occupy a considerable acreage on the diluvium in the same

[54] T. Yamazaki: Patterns of Settlements on Musashino Uplands; *Geog. Rev. of Japan*, Vol. IX, No. 9, Sept. 1933, pp. 766-774 (in Japanese).

general region, but both of these are dwarfed by the area in mulberry, that crop occupying several hundred-thousand acres, for western Kwanto, like Fossa Magna, is one of the greatest silk producing regions in the country. On some parts of the terrace uplands it appears to be the single greatest crop; this is more especially true in the western portions of the plain where in some localities 30 to 50 per cent of the cultivated area is in mulberry.

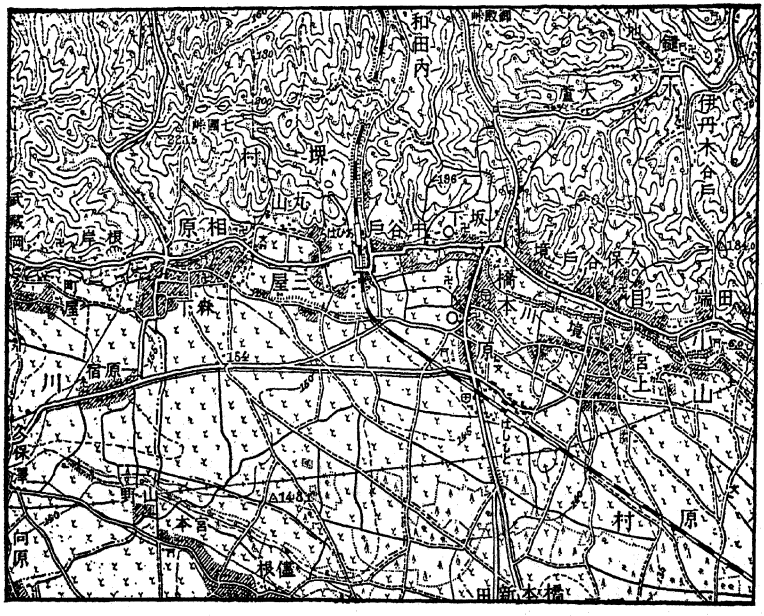


FIG. 33.—A section of the more dissected Tama terrace of Kwanto (to the north) and the lower, flattish Musashino terrace (to the south). Note the contrasts in land use and settlement types as well. Mulberry is the outstanding crop on the lower terrace. Dispersed settlement is characteristic of the rougher land. Scale 1:50,000.

On the higher, older and more dissected terraces of the Tama group, settlement as well as being more meager, is also more concentrated, the isolated farmsteads and small agglomerations being largely confined to the narrow valley bottoms where paddy lands form an intricate dendritic pattern. Some dry-crop slope cultivation is practiced, but the larger part of the hill land is covered with trees or wild grasses and shrubs.

On the recently emerged coastal strips bordering the plain proper, there is a tendency for settlements, both dispersed and agglomerated, to congregate on the low beach ridges. There is

considerable low wet land, so that rice is an important crop, often occupying the troughs between the sandy ridges, which in turn are planted to mulberry, ordinary dry crops, or protective rows of trees. This parallel arrangement of contrasting cultures is not, however, everywhere conspicuous.

Urban Units of Kwanto.—Of the more than 80 cities and towns on Kwanto with populations exceeding 10,000, there are two, each with tidewater location, which rank among the nation's six metropolises (over 600,000 population), Tokyo, Nippon's capital and largest city,[55] and Yokohama its second port. Both are manufacturing centers of consequence and together comprise Japan's second greatest industrial node. It needs to be emphasized that although they are separate political entities, in a very real sense they comprise and function as a distinct conurbation, each unit of the combination being complementary to and dependent upon the other. In this respect they closely resemble that other great binuclear conurbation in Kinki composed of Osaka and Kobe. In each pair the larger city functions principally as the great consuming and industrial center while the other serves as its deep-water port, with this difference however, that Tokyo is less of an industrial and more of a political and administrative center than is Osaka.[56]

Although Kwanto, the immediate hinterland of Tokyo-Yokohama, is Japan's single greatest settlement unit, with over one sixth of the country's inhabitants, the service area of these cities is by no means confined to that plain, but in a very genuine sense includes all of northern Japan. The almost complete absence of significant ports in northern Honshu testifies to the overshadowing influence of the Kwanto "hafenpaar". In radial pattern from this urban center on Tokyo Bay, rail lines spread out across Kwanto, tapping the more distant hinterlands beyond. The famous Tokkaido Line follows the coast to the southwest; two lines progress westward toward Fossa Magna and beyond to the Hokuroku coast, so that Nagano silk is drawn off toward Yokohama; other routes to the north tap

[55] In 1932, by annexation of suburban territory, Tokyo displaced Osaka as the nation's metropolis.

[56] Dr. L. Mecking; Japan's Seehäfen und ihre Neueste Entwicklung: *Meerskunde*, Vol. XVI, No. 8.

the fertile meridional basins of Ou, also specialized in sericulture.

Tokyo. For reasons previously stated, Tokyo, formerly Yedo, remained an insignificant fishing village for centuries after the great cities of the southwest had reached maturity. It became a daimyo's headquarters in the mid-fifteenth century but it was not until the latter part of the 16th century, when Yedo became the capitol of the usurping Tokugawa shoguns, who ruled the country for two and one-half centuries, that rapid development began. During this period Yedo was a vast military encampment with the nearly impregnable shogun's castle on a diluvial bluff overlooking the bay, and the fortress-like dwellings of the daimyos or feudal lords spread out on the floodplain below it. After the fall of the shoguns, Yedo's threatened decadence was averted when the restored Mikado made it his "East Capital" and renamed it Tokyo.

The modern city located at the head of Tokyo Bay occupies two contrasting kinds of sites, much of the eastern or commercial, business and manufacturing portion of the city being on low floodplain and delta sediments of the Sumida river, while the western half, chiefly residential and political, is built upon the dissected margins of a diluvial upland whose crests are 20 to 40 meters above sea level. Relatively steep grades mark the transitions from one level to another. Considerable areas of recently reclaimed land border the bay. The moat and wall-enclosed Imperial Palace, strategically located on the extreme eastern margin of the diluvial plateau, has been the core around which accretion has taken place and even yet it is near the geographical center of the modern city as well as the focal center of a cob-web pattern of urban transport lines.[57] Even beyond the city limits these radial highways localize urban development in the form of modified "strassendorf" settlements so that octopus form is conspicuous. Throughout the commercial and industrial sections, which occupy floodplain and delta sites, the city plan is somewhat more rectangular than in other parts.

[57] By a recent inclusion act of Oct. 1, 1932 Tokyo City has been increased in area from 31.4 to 220.2 sq. miles and in population from 2,071,000 to 5,312,000. A considerable part of the area added is rural in aspect and is a portion of a very intensively developed market garden zone, where by intensive rotation methods 5 or more crops of vegetables are obtained in one season. See S. Sugai: Land Utilization in the Vicinity of Tokyo, *Geog. Rev. of Japan* 5 (1929) 1699-1722; 6 (1930) 21-28 (in Japanese).

Canals and canalized rivers thoroughly intersect the lowland district requiring hundreds of bridges. Many of the buildings of "downtown" Tokyo are supported on piles. As a result of the three-day fire following the earthquake of September 1, 1923, nearly one half of the city, largely the commercial and industrial section, was destroyed.[58] Such wholesale destruction had at least one bright side, namely that it permitted a thorough execution of a new city plan so that Tokyo today is in metamorphis; an oriental city being remodeled on occidental lines.[59] It "is one of the most comprehensive projects ever undertaken by a modern community." The grid pattern of streets is being perfected while at the same time radial streets and girdling boulevards are being evolved. Thoroughfares are being widened and straightened so that while in pre-conflagration days the aggregate area of streets was only 11.6 per cent of the city's area,

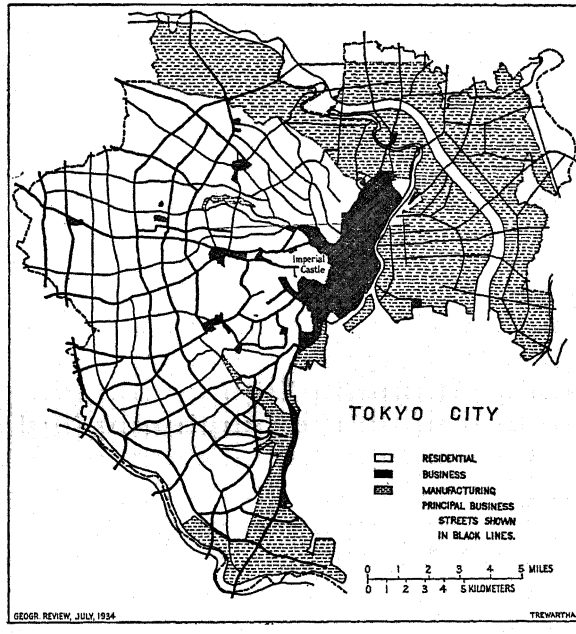


FIG. 34.—(Plate loaned by the Geographical Review published by the American Geographical Society of New York.)

[58] 370,000 houses were burned; 58,104 were killed, 38,824 missing or injured; total loss of wealth 3,662,000,000 yen. The city's population declined by over 950,000.

[59] Reconstruction and Development of the Tokyo-Yokohama District, Trade Information Series 69 of U. S. Dept. of Commerce, Bur. of For. & Dom. Commerce, Washington, 1928.

this will be increased to 27 per cent in the downtown, fire-destroyed sections. 523 bridges, entirely new or reconstructed, have been built, 14,400 meters of canals and river have been improved, and extensive areas of park have been provided.[60]

The business or commercial core of the city occupies a north-south elongated strip of low lying alluvial land bounded by the Sumida River and Tokyo Bay on the south and east, and by the diluvial uplands on the west. It is in this section of Nippon's capital that occidental influence has been felt most. New modern fireproof buildings four to eight stories in height with large display windows are numerous. Taxis, busses and tram cars crowd the streets. Smaller, isolated, but compact, business areas exist within the general manufacturing and residental areas, while combination shops and residences seem to flank almost all of the principal streets and many of the secondary ones as well throughout all parts of the city. Thus to a much greater extent than in American cities, the commercial pattern outside the core is coincident with the street pattern. Structures along such business streets are predominantly small open-front shops, with families living in the second stories or in the back rooms.[61]

Industrial Tokyo occupies two distinctly separate areas: (1) the larger and more important one in the eastern and northeastern part of the city along the Sumida and Arakawa waterways and their numerous canalized tributaries; while (2) a less important area lies south of the commercial core along the west coast of Tokyo Bay and is the northern end of a coastal manufacturing belt connecting Tokyo and Yokohama.[62] By no means are these areas exclusively manufacturing, for they contain the homes of thousands of industrial workers as well as local business centers and business streets. Considerable portions of these industrial districts are on reclaimed land along the margins of the Bay. To some degree also, small manufacturing plants are concentrated along the outer belt-line of railroad which encircles Tokyo on the west, lying just beyond the limits

[60] *Tokyo, Capital of Japan: Reconstruction Work 1930.* Published by Tokyo Municipal Office.

[61] H. Sasaki: Reconnaissance of the City Center of Tokyo, *Geog. Rev. of Japan*, Vol. IX, No. 9, Sept. 1933, pp. 755-765 (in Japanese).

[62] See map opposite p. 52 in Tokyo, Capital of Japan: Reconstruction work, 1930. See also, Y. Takemi: Distribution of Factories in Greater Tokyo (in Japanese), *Geog. Rev. of Japan*, Vol. VI; No. 7, July 1, 1930, pp. 369-386.

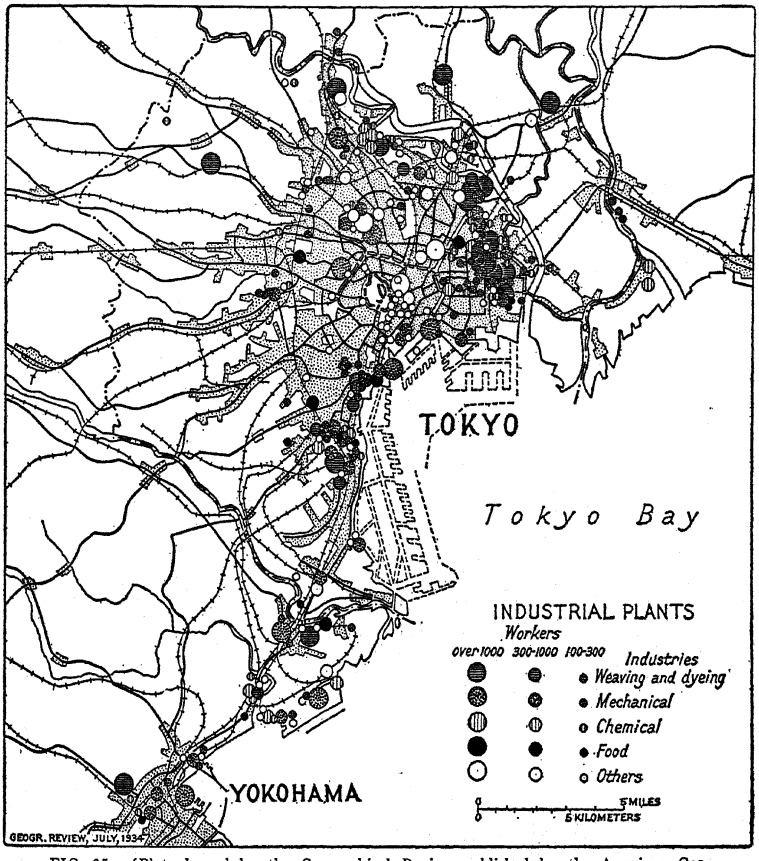


FIG. 35.—(Plate loaned by the Geographical Review published by the American Geographical Society of New York.)

of the city proper. Very emphatically localization of factories has been influenced by availability of cheap transport facilities, particularly by water, even though only shallow draft barges can be accommodated on the rivers and canals of the industrial district. Warehouses and industrial plants prevailingly occupy canal sites so that coal and raw materials can be unloaded at their very doors.

Workshops rather than large factories are the typical industrial units of Tokyo, 31 per cent of the laborers working in plants employing fewer than 15 workers.[63] Tokyo's distance

[63] This does not include those establishments with fewer than five workers that do not use power.

from large coal fields, its lack of heavy metal industries, and the prevalence of earthquakes may be partial explanations for the predominance of small manufacturing establishments. As a result, those objectionable landscape features which we usually associate with manufacturing, and which are so obvious in Osaka and the North Kyushu cities, are relatively subdued in the capital city of Nippon. Diversity rather than specialization is characteristic but with textiles, machinery, rubber, glass and paper manufacturing standing out as being of more than local significance. Cotton spinning establishments are characteristically of factory size although most of them are outside the limits of the city proper.

Residential Tokyo, in contrast to the commercial and industrial sections, occupies chiefly upland locations west of the Imperial Palace, but throughout its whole extent business streets are very numerous. Residential types are predominantly Japanese in architecture; only in certain newer sections do houses give evidence of foreign influence.

Being at or near the mouths of several rivers at the head of a silting bay, Tokyo harbor is so shallow that only very small boats (not over 3,000 tons) can enter with the result that it is not an "open port" and its foreign trade is nil.* Even the entrance of small boats has been made possible only by the dredging of the harbor to a depth of 6.5 to 7.5 meters together with the excavation of a narrow marked entrance channel 7 kilometers long. Tokyo's waterborne commerce is therefore almost exclusively barge and lighter traffic from its deep-water foreign-trade port, Yokohama, 18 miles down the bay, together with coastwise trade to and from other Japanese ports. Being primarily a great consuming market, and distributing center, the value of Tokyo's import trade (coal, vegetables, fruit and particularly fish) is 7 times that of its exports. Heavy bulky raw materials are not so conspicuous in the import list as they are for instance in Osaka's, where large-scale factory manufacturing is better developed.

Yokohama. Yokohama is one of those few Japanese cities which had little or no contact with the feudal period, being called into existence by the exigencies of the modern era. Although

* Tokyo ranks fourth (after Kobe, Osaka, Yokohama) in total waterborne commerce.

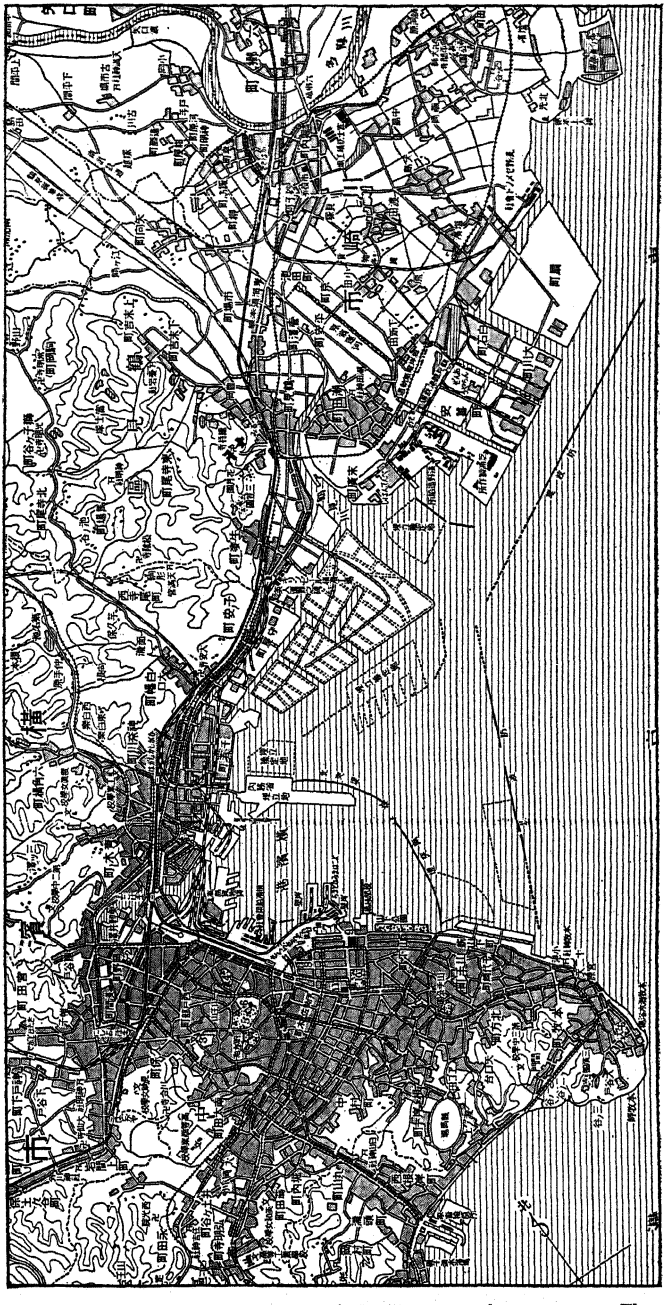


FIG. 36.—Yokohama, the deep-water port of the Kwanto settlement area. The principal business section is on the largest and most southerly of the three small delta-plains. Industrial plants tend to concentrate along the ocean margins farther north, partly on recently reclaimed land. (From, Encyclopedia of Japanese Geography, Tokyo.)

only a fishing village when Perry arrived in 1853, it is now a metropolis of 620,000 and one of the nation's two really great ports. Pre-eminently it is a port city and its growth has been closely associated with its expanding services as a foreign-trade port, not only for Tokyo and the Kwanto region, but for all of northern Honshu as well. Lying in a small indentation along the west side of Tokyo Bay, it has adequate depth of water and docking facilities so that the largest Pacific boats are able to anchor alongside the piers. Most freighters, however, anchor at buoys and load and unload with the aid of lighters.

Prior to the earthquake and fire of 1923, which destroyed 28 per cent of the urban area, Yokohama was, by a slight margin the ranking port of Japan. At least partly as a result of that catastrophe, many coasting vessels which had formerly docked at Yokohama proceeded directly to Tokyo, while Kobe succeeded in diverting to itself a portion of the Kwansai silk export which had belonged to Yokohama.[64] As a result the Kwanto port has dropped to second place, handling only 31 per cent of the country's foreign trade in 1929 as compared with 36 per cent for Kobe. Exports always exceed imports, for even yet in the neighborhood of 70 per cent of the raw silk, which normally amounts to 35 to 40 per cent of the country's export, leaves through Yokohama. This one item comprises 65-70 per cent of the port's outgoing trade and this is increased to nearly 80

COMPOSITION OF THE FOREIGN TRADE OF YOKOHAMA 1929*
(in yen)

Exports		Imports	
Raw silk and waste silk	582,743,000	Automobiles, machines, tools, etc.	71,125,000
Silk fabrics	61,247,000	Metals and crude metal products	55,576,000
Canned crab meat and fish oil	17,778,000	Raw cotton	47,903,000
Wheat flour	17,814,000	Wheat	41,755,000
Refined sugar	8,557,000	Timber	31,921,000
Toys	7,824,000	Petroleum	27,902,000
Cotton textiles	5,223,000	Wool	22,960,000
		Oil cake	19,367,000
Total (including all others)	781,857,000	Soy beans	15,536,000
		Sulphate of ammonia	14,058,000
		Total (including all others)	582,460,000

* In 1932 exports amounted to 400,659,000 yen and imports 355,358,000 yen.

[64] It has been estimated that 60 per cent of the filatures of Japan are nearer to Yokohama than to Kobe. Trade Promotion Series, Bull. 69, U. S. Dept of Commerce.

per cent if silk fabrics are included. Yokohama's fame as a silk port reflects the specialization of Central Honshu, its trade territory, in sericulture, and likewise explains the port's close association with the American market which absorbs 82 per cent of its exports and supplies 35 per cent of its imports. Among the entering commodities at Yokohama there is much greater diversity, the list being longer as well.

As a port for domestic waterborne commerce Yokohama is likewise outstanding, with 550,000,000 yen of exports and 275,000,000 yen[65] of imports. This discrepancy between the value of entering and outgoing domestic commodities reflects Yokohama's position as distributor to other parts of Japan, chiefly by water, of the foreign goods received at its wharves. On the other hand silk, its single large foreign export, arrives from the interior by rail. The principal domestic trade of Yokohama is with Tokyo, the freight being transferred by lighters, some 3,000 of these cargo boats being owned at the former port.[66]

The city of Yokohama occupies three kinds of sites: (1) in complete and compact fashion three small wedge-shaped delta-plains opening out upon Yokohama Bay; (2) spurs of diluvial upland 40 to 60 meters high which separate the three delta-plains, these being much less completely urbanized, and (3) a coastal strip, considerable part of which is recently reclaimed land, extending northward along the coast, this too being only urbanized in part. The small streams which have formed the three delta plains occupied by the city do not carry enough load to seriously silt the harbor. On the other hand, they provide a splendid network of waterways throughout the lowland portions of the city, offering exceptional transport advantages to business and industry. Of the city's area, 58 per cent is classed as residential in character, 25 per cent as commercial or business, and 17 per cent as manufactural.[67] The heart of Yokohama, containing its commercial core, is on the southernmost of the three alluvial plains, immediately back of the principal piers. This business core of the city, together with the foreign residential quarters, are the most exclusive sections as far as the purity of their functional forms is concerned. Be-

[65] L. Mecking, Japan's Häfen, *op. cit.*, p. 485.
[66] *Ibid.*, p. 485.
[67] *The Far Eastern Review*, 1929, p. 317.

fore the earthquake this business section had a distinctly occidental appearance, but it was here that damage, particularly from fire, was most severe. Like Tokyo, Yokohama is an oriental city in metamorphosis, but progress seems to be somewhat less advanced than in the Capital. Numerous large fire and quake-proof buildings have been erected but the number of small Japanese structures, some of them obviously temporary, are more conspicuous than in Tokyo. Although many foreign firms moved their offices and plants to Kobe following the earthquake, the cosmopolitan nature of Yokohama is still obvious from the fact that in 1928 there were 175 foreign firms within the city.[68]

Although residential forms occupy both low and high-level sites, they are much more exclusive on the flanks and crests of the diluvial spurs. However, in such locations occupance is less complete and compact and the pattern of streets less rectangular than on the lowlands.

Manufacturing functions in Yokohama have always been somewhat overshadowed by trade, the restricted area of level land for factory sites being at least one handicap to industry. Within recent years however there has been an augmented acceleration in industrial development so that between 1922 and 1929 there was an increase of 31 per cent in the number of factory workers. Small inconspicuous manufacturing plants occupy canal sites throughout the lowland city but the most exclusive section, where large factories are relatively numerous, is a somewhat attenuated and incompletely urbanized coastal belt extending northward and joining with that of Tokyo. An extension of Yokohama's boundaries in 1927 brought this industrial area, including the principal Tsurumi center, within the city limits. Large areas of new land have been, and are still being, reclaimed along the coast to provide sites for additional plants. Excellent deep-water canals and spur-railroad tracks serve these reclaimed lands, the splendid transport facilities having attracted a considerable number of relatively large industrial concerns—petroleum, glass, cement, shipbuilding, flour milling and machines and tools. The total value of goods produced in Yokohama's factories in 1929 amounted to 206,488,000 yen of which nearly 69,000,000 were metal products, 68,000,000 foods

[68] Mecking: Japan's Häfen, *op. cit.*, p. 480.

and beverages and 33,000,000 chemicals.[69] Shipbuilding and repairing is the ranking industry, Yokohama together with Kobe and Nagasaki, comprising the nation's three great centers for marine construction. Blast furnace and steel manufacturing equipment have recently been added to the Asano Shipbuilding Company's plant.

3b. SUN-EN COAST (The Pacific Littoral from Izu Peninsula to Ise Bay.). Composed as it is of relatively small isolated delta-fans separated by spurs of hard-rock hills or diluvial terraces, many of the numerous physical units having distinctive individuality in both natural and cultural features, the Sun-en section of Tokai does not lend itself so well to a synthesized and general description. Nevertheless since most of this subdivision has been treated at some length in an already published monograph on Shizuoka,[70] only a very short and condensed summary, somewhat out of proportion to the importance of the region, will be offered here.

The densely populated delta-fans in general have characteristic paddy landscapes. Only the Tenryu and Oi plains are really distinctive, the former by reason of the large number of raised plots planted to dry crops, and the latter because of its distinct fan contour, relatively steep gradients, and its dispersed settlements. This latter feature seems to be associated with a vigorous and errant river which retarded occupance of the fan until comparatively recent times and likewise led to the selection of elevated dry spots for settlement sites.[71] It may be that the distinctive two-storied landscape of the Tenryu Plain is likewise associated with a vagrant river. Along the open coast west of Cape Omae wide belts of sandy beach ridges and dunes are characteristic, coastal settlements are few and fishing is meagerly developed. Such formidable dune belts are absent along the protected coasts of Suruga Bay, and here the low beach ridges are important sites for settlements and for specialized truck and market gardening developments, fast rail service carrying the perishable products to the great urban centers both to the northeast and southwest.

Diluvial terraces composed of sand and gravel strata, capped

[69] Yokohama Chamber of Commerce.
[70] Trewartha: A Geographic Study of Shizuoka Prefecture, Japan. Op. cit.
[71] *Ibid.*, pp. 240-242 and 250-252. See also *An Encyclopoedia of Japanese Geography* (in Japanese) Vol. 6, p. 267.

with volcanic ash, are conspicuous features of Sun-en, some of their smooth flattish crests being 150 to 300 m. high. These diluvial uplands, as well as the lower slopes of the hard rock hills adjacent to the alluvial plains, especially in eastern Sun-en, are characteristic sites for specialized development in two nationally famous commercial crops, green tea and Satsuma or

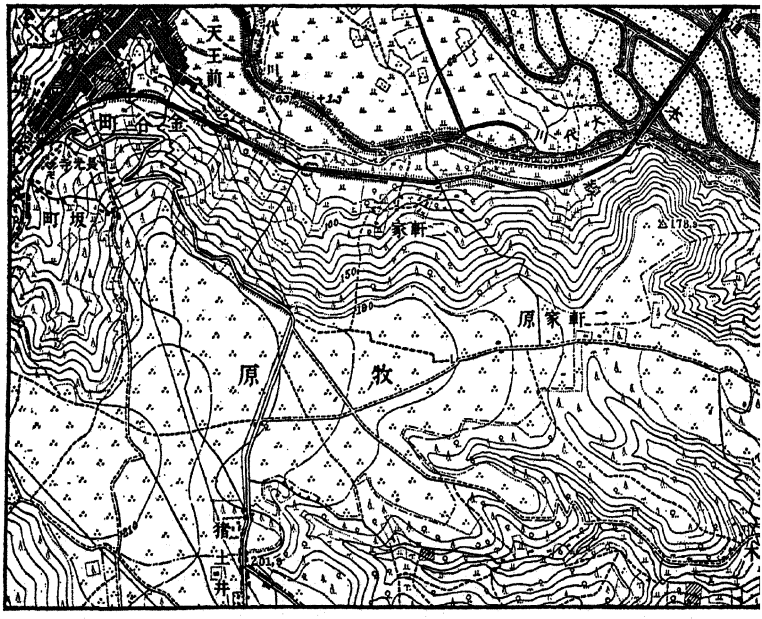


FIG. 37.—A section of high Makinohara diluvial terrace, Shizuoka Prefecture, (between the Kwanto and Nobi Plains). This is a specialized tea growing region, the flattish crest of the terrace being covered almost exclusively with tea gardens. Scale 1:25,000. See plate 10.

mandarin oranges. Being the most hardy and soil tolerant of the citrus family, mandarin groves occupy, for the most part, rocky hillside sites facing Suruga Bay. Extraordinarily mild winters and heavy precipitation favor the citrus crop. Approximately one half of Japan's tea crop is grown on these same hard-rock foothills and on the ash-covered terraces of Sun-en. Reasons for this concentration are not entirely clear, but it may be related to the abundance of rainfall (80 inches or more) and the extensive area of diluvial upland. Tea gardens are small, usually under an acre in size, and are often interspersed with vegetable plots. Three pickings of leaves a season are customary, the fresh leaves being fired immediately so that the

product is the "green" variety. Numerous inconspicuous "firing" stations are widely scattered throughout the rural villages in the tea regions, but refiring and packing plants are concentrated in Shizuoka City, which is headquarters for foreign and Japanese exporting firms. United States, Russia and Canada are the principle foreign markets, nearly all of the exported product passing through the local roadstead port of Shimizu lying back of Miho spit where large ocean liners call at only two seasons, in winter for oranges and in summer for tea. West of Cape Omae, perhaps partly due to the more exposed location, the foothills and diluvial terraces are less completely utilized and oranges and tea are both reduced in acreage.

Lying between the ancient political, as well as the present urban and industrial, centers of Kwanto and Kinki, Sun-en has for centuries been a famous transit region. Today it is crossed by Japan's two most famous thoroughfares, the Tokkaido Highway and Railway. Many of its settlements grew up as castle towns or hostelry centers along that most famous ancient Japanese thoroughfare, the Tokkaido.

Included within the nation's industrial belt, but one of its more attenuated sections rather than a major node, Sun-en has a variety of industries. Three local concentrations can be noted. (1) In Eastern Sun-en, at the bases of Fuji and Ashitaka volcanoes, are 20 to 30 small hydro-electric plants as well as 5 large paper mills, 6 smaller ones, several filatures, and at least 3 textile establishments, one handling cotton, another wool and a third ramie. The principal advantages of the location are the abundance of both cheap hydro-electric power and clean water, as well as the close proximity to rail and ocean transportation. The ancestors of the present paper factories from which these modern ones have evolved chose the location because, in addition to available waterpower, the adjacent volcanic slopes produced a wild shrub or bush used as raw material. (2) In and around the castle town of Shizuoka City (136,000) are concentrated a number of plants for refiring, blending and packing tea as well as a large cotton spinning mill and several small box factories. (3) Hamamatsu, the western metropolis (109,000), also a castle town, is the local center of a relatively important textile region, specialized particularly in the weaving of inexpensive cotton cloth. Within the city and its vicinity are

1,600 to 1,700 small weaving establishments, all using electric power, two thirds to three fourths of them employing fewer than 10 workers. Many of the plants are no more conspicuous than an implement shed on an American farm. The present power-loom weaving industry of the Hamamatsu region is the offspring of an earlier household-industry forbear, although availability of cheap electric power within the past few decades, and expanded markets during the World War, have greatly stimulated its growth.

3c. Nobi or Nagoya Plain and Associated Lowlands Bordering Ise Bay.—Coincident with the lowlands bordering the tectonic Bay of Ise, and more especially on its bay-head delta-plain, Nobi, next to Kwanto the largest lowland in southwest Japan, is one of the nation's major compact settlement units, including its third largest city, Nagoya (907,000), and one of the four important nodal centers in its industrial belt. Industrially, what Tokyo is to Kwanto, and Osaka to Settsu, Nagoya is to Nobi, but unfortunately for the latter lowland there is no comparable deep-water port such as Yokohama or Kobe serving as a gateway for ocean trade. In the neighborhood of 4,500,000 people comprise this Ise Bay population cluster, 2,750,000 of them being concentrated on the Nobi plain.[72]

The eastern and western borderlands of Ise Bay are composed of narrow fringes of new alluvium bordered on their landward sides by wider belts of diluvial terrace. In the Kinki area to the west, as well as in the vicinity of Ise Bay, much of the area shown on many geological maps as Tertiary is really higher and older diluvial terrace, composed of unconsolidated sediments. Large areas of this high terrace have been reduced by erosion to almost a bad-land type of surface where occupance is meager. In the valleys there is some rice and mulberry, the former crop often irrigated from artificial ponds. Most of the surface appears to be in trees or left waste. On the surfaces of the smoother lower terraces, rice as well as dry crops, including tea, oranges, and much mulberry, are conspicuous. Settlement is both dispersed and agglomerated. The low new alluvium bordering the bay is largely in paddy fields. On the west side of

[72] L. Mecking: Japan's Häfen, *op. cit.*, p. 428-429.

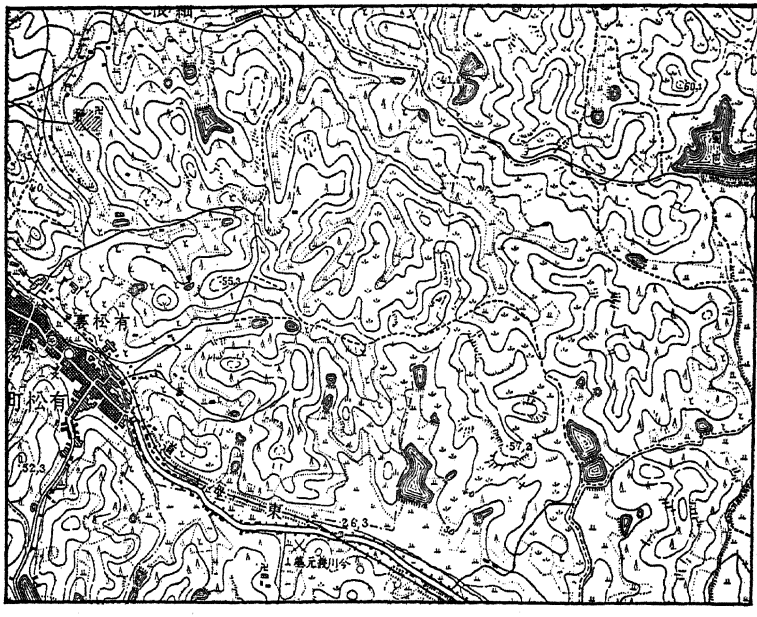


FIG. 38.—A dissected portion of high terrace east of Nagoya Bay. Rice, irrigated from artificial ponds, occupies portions of the valley floors. The slopes are covered with scrub vegetation. Scale 1:25,000. See plates 39, 40 and 41.

the bay, 23 miles south of Nagoya, is the roadstead port of Yokkaichi (52,000), serving not only a restricted local hinterland, but likewise, in a small way, functioning as the outer port of industrial Nagoya as well. Recently, with improvement of Nagoya harbor, the latter function is waning, so that in 1930 the value of Yokkaichi's foreign trade was only 28 percent that of Nagoyas. Some large trans-Pacific steamers which still call at Yokkaichi do not proceed farther up the Bay to Nagoya. In normal years it holds a rank of sixth or seventh among the Japanese ports, imports, largely raw materials for manufacture, being usually three to five times the value of exports. Yokkaichi and other towns of the Ise Bay coasts are within the general Nagoya industrial region, and like it are engaged in textile manufacture, both silk and cotton. The single greatest foreign import is raw cotton from British India with soy beans and beancake from Manchuria and wood from the United States holding high positions. Reflecting the hinterland's specialization in cheap porcelain manufacture, Yokkaichi's principal foreign export is chinaware. In coastwise shipping the order is reversed

and exports, chiefly industrial wares, are double the value of imports.

The relatively large plain of new alluvium at the head of Ise Bay, or Nobi Proper, is crossed by several diked streams in braided courses, with remnants of their fossil channels to be found in various parts of the plain. Portions of its western area are still poorly drained. Population is excessively dense, 500-1,000 per sq. km. being normal for large parts, which is conspicuously higher than for most of Kwanto. Uniformity of settlement types is lacking, the drier areas showing a tendency toward small compact agglomerations, while in less well drained areas dry sites are sought after, resulting in elongated types of villages or even isolated farmsteads.

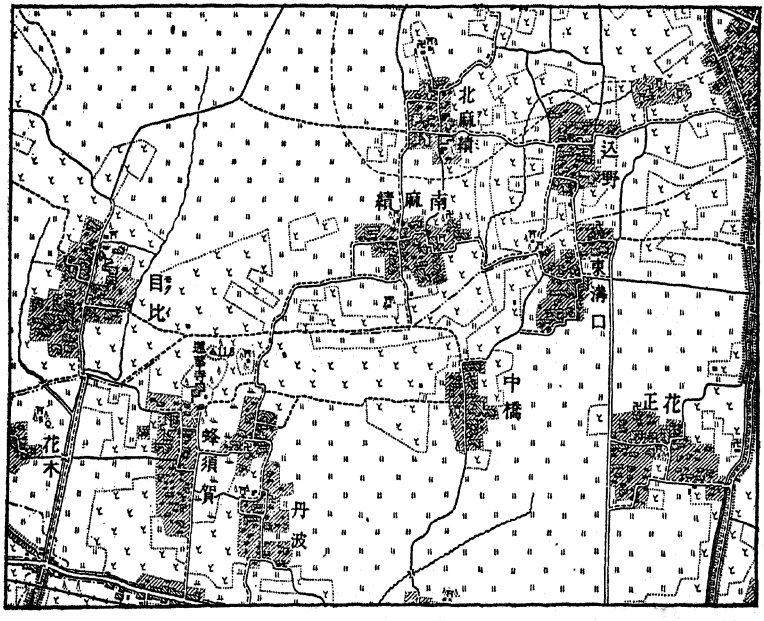


FIG. 39.—A section of the Nobi or Nagoya Plain, showing a dense rural population living in compact towns. Mulberry and other dry crops occupy considerable areas, competing with rice even on the new alluvium. Scale 1:25,000. See plate 38.

Agriculturally Nobi has distinction by reason of the relatively large amount of its area devoted to unirrigated crops, especially mulberry, even though the plain is composed principally of new alluvium. No doubt the larger part of this lowland is planted to irrigated rice but not so exclusively as are most of

them, with the result that the Ise Bay district, along with Kwanto and the fault basins of interior Chubu and southern Ou, are the most important regions of silk production in Japan. This is somewhat unusual, for mulberry, not requiring irrigation, and being very soil tolerant, is usually forced by crop competition to such locations as hill slopes or diluvial uplands, but here in Nobi it competes with rice in the latter's own environment. In part the unirrigated crops occupy individual raised plots among the paddies, but relatively extensive contiguous areas of mulberry, and some other dry crops as well, are also common. Along the diked river courses and around the villages and cities mulberry and vegetables are especially conspicuous. Certainly the presence of the great industrial city of Nagoya has been an important factor in inducing a degree of specialization in market gardening on the adjacent lowland.

Located on the southeastern margin of the Nobi Plain, its core about 4 miles from the sea,[73] Nagoya occupies a very low diluvial terrace whose relatively smooth surface is only 5 to 15 meters above sea level. There is adequate level land for expansion. The city's funnel shape tapering toward the south is the result of intentional coincidence with the drier diluvial site. It is today an important commercial center on the Tokkaido railway and the converging point of rail lines from four directions. Nagoya's low diluvial site protects the city from the serious floods which scourge the adjacent alluvial lands and yet is not high enough to entirely preclude canals, although they are not numerous. At the north end of the city, occupying a diluvial eminence 20 meters high, is a magnificent feudal castle, a relict of those days when Nagoya was a large and prosperous city between the Kwanto and Kinki capitals on the Tokkaido Highway. The old city core just to the south of the castle has a remarkably rectangular street grid. Although preeminently an industrial city lying in a region which is expanding in manufacturing more rapidly than almost any other part of Japan, this accelerated development is largely a case of making up for an earlier retardation due to inferior facilities for water transport and their late improvement. Like Tokyo and Osaka,

[73] The municipal boundaries enclose 148 square kilometers which is much greater than the area of the geographical city. By inclusion of only partly urbanized land on the south the city limits now extend to the head of the bay.

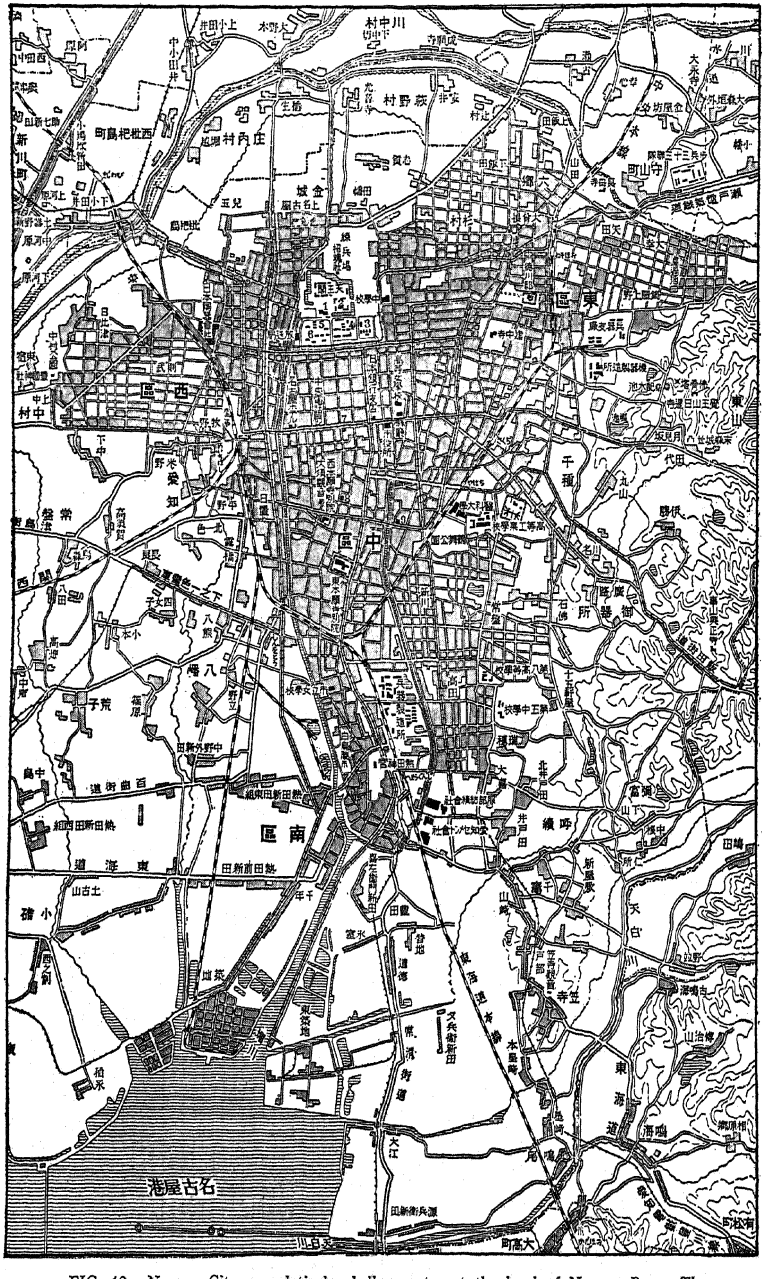


FIG. 40.—Nagoya City on relatively shallow water at the head of Nagoya Bay. The original nucleus of the city was the moat and wall-enclosed daimyo castle, conspicuous on the map toward the morthern margin of the city. From, Encyclopedia of Japanese Geography, Tokyo.

Nagoya is located on a bay-head plain where silting rivers have shallowed the coastal waters so that ocean boats could not approach the coast, but unlike them it had no adjacent deep-water port such as Kobe or Yokohama. Manufacturing industries first became important in those parts of Japan provided with adequate water transport. Not only was the original city nucleus located four miles inland from shallow tide water, but likewise within the city itself, because of its diluvial foundation, the network of canals was not comparable to that of either Osaka or Tokyo, thereby making the movement of goods more difficult. The city was thus largely dependent upon rail service. Its trade territory is primarily the borderlands of Ise Bay with their 4,500,000 inhabitants, which comprise a major settlement area and consuming center. Largely because of the proximity of Osaka and Kobe, the outer hinterland of Nagoya is somewhat limited. By way of the Kiso valley, however, it has extended its influence toward the Matsumoto and Suwa grabens of Fossa Magna, and through the Biwa depression to the Japan Sea coast.

Within recent years harbor improvement has resulted in Nagoya becoming the nation's fourth port,* but it is a poor fourth with only 11 per cent of Kobe's, and 22 per cent of Osaka's trade. The narrow dredged channel (8.5 m. deep) up the bay and the restricted turning space in the harbor still discourage the large trans-Pacific boats from calling at Nagoya and consequently their cargoes destined for that city must pass through Kobe, Osaka or Yokkaichi and eventually reach Nagoya by rail or lighter.** However, boats up to 10,000 tons can now be accommodated, some using the new dock, more of them anchoring at buoys and being serviced by lighters. Connecting the harbor with the city proper is a railroad line and several canals. The older canals are at present too shallow to be of much value but the new Nakagawa Canal, completed in 1930, which is 6,391 m. long, 63 to 91 meters wide and 2± meters deep at low tide, may be destined to play a genuinely important role. A strip 51 meters wide on either side of the canal has been converted into landing stages, with warehouse sites and roads, while beyond these strips the land has been filled in and prepared for factory sites.[74]

* In foreign trade.
** Recent reports indicate that some trans-Pacific boats now call at Nagoya.
[74] *Guide to Nagoya*, Nagoya Municipal Office, 1931, p. 34.

Partly as a consequence of these harbor improvements, the water-borne commerce (foreign and domestic) at Nagoya has increased from 28,000,000 yen in 1908 to 306,000,000 yen in 1928, 135,000,000 of this being foreign trade, divided between exports and imports in the ratio of 50 to 85. In spite of Nagoya's specialization in cotton spinning and weaving, wool,

PRINCIPAL ITEMS OF NAGOYA'S FOREIGN TRADE, 1928*
(in yen)

Exports		Imports	
Porcelain and pottery	18,772,000	Wool	27,548,000
Cotton cloth	15,883,000	Cotton	7,817,000
Boards of wood products	3,661,000	Lumber	7,603,000
Beer	2,536,000	Wheat	5,653,000
Clocks	1,413,000	Coal	5,419,000
Sugar	1,188,000	Fertilizer	4,474,000
		Rice	3,735,000
		Fodder	3,322,000
Total (including all others)	50,023,000	Sugar	2,249,000
		Beans	1,709,000
		Total (including all others)	85,084,000

* In 1931 exports amounted to 37,911,000 yen and imports to 64,999,000 yen.

largely from Australia, exceeds cotton in value in the import list principally because the latter commodity is landed by larger boats at the deep-water port of Kobe or possibly Osaka and so arrives at Nagoya as a domestic import. The cotton textiles for export likewise leave from Kobe and Osaka. As at Yokkaichi, porcelain and pottery hold the ranking position among exports from Nagoya harbor reflecting the specialization of Aichi prefecture in that industry. For the most part it is a workshop industry of Nagoya and the villages, abundant local kaolin deposits supplying the raw material.

Third in importance among the industrial nodes of Japan, Nagoya had in 1928 nearly 1,800 manufacturing plants employing over 5 workers, but only 39 of these employed 300 or more workers and 148 of them more than 50 employees.[75] Regional concentration of the plants is not so obvious as in Tokyo, but in general they tend to collect in a Y-shaped industrial area at the southern end and along the eastern and western margins of the city where rail and canal transport serv-

[75] Nagoya Municipal Office.

ices are available. Sawmills and dyeing and bleaching establishments, are particularly attracted to canal sites.

The whole Ise Bay industrial region is emphatically specialized in textiles, with silk reeling of first importance and cotton weaving next in rank. Although this is one of the three or four greatest sericultural nodes in Japan, the filatures are not conspicuous for they are neither large nor particularly concentrated, being distributed throughout the numerous villages of the plain and its bordering hill lands. Nagoya City, which is the focal center of the general industrial region, is similarly specialized in textiles, that group of plants in 1928 employing nearly one half of the workers in industry and accounting for nearly 60 per cent of the value of manufactured wares. Unlike its hinterland, the metropolis does not primarily emphasize silk reeling, but concentrates instead upon cotton manufacture, both spinning and weaving as well as dyeing, Spinning is primarily a large-factory industry; weaving on the other hand is housed in small plants, often of workshop size. Much of the manufactured cloth is intended for export and since a considerable proportion of it passes through the ports of Kobe and Osaka, it is often halted for finishing and dyeing at the latter city. Abundant supplies of hydro-electric power of which the textile industries are the principal consumers, have been an important factor contributing to Nagoya's manufacturing development.

MANUFACTURES OF NAGOYA VALUED AT OVER 5,000,000 Yen in 1928*

Cotton piece goods	117,150,000
Cotton yarns	46,952,000
Porcelain and pottery	22,322,000
Woolen yarns	18,687,000
Woolen goods and woolen mixtures	15,643,000
Flour	14,016,000
Beer	8,071,000
Cakes and confectionery	7,745,000
Steam and electric railway cars	7,498,000
Knitted goods	7,462,000
Medical supplies	6,429,000

* *Guide to Nagoya, op. cit.*, p. 14.

*

D. THE INNER ZONE OF SOUTHWEST JAPAN

This triparted region of Nippon, containing as it does portions of Honshu, Shikoku and Kyushu, has for the most part a hilly rather than a mountainous configuration, much the larger part being under 1,000 meters. Because of the abundance of granite, rounded rather than sharp forms are conspicuous. The most dense and complicated fault net of any part of the country is here characteristic. Indeed the whole Inland Sea with its ragged shore lines and numerous islands is the result of block crustal movements along some of these fault lines. Lowlands of conspicuous size are largely lacking, the Settsu or Osaka Plain at the head of Osaka Bay at the extreme eastern end of the Inland Sea being the largest. Minor alluvial fragments occupying small coastal indentations are characteristic. Along the entire southern boundary of the region in all three islands, separating it from the Pacific Folded Mountains, is a very conspicuous morphological fault.

All lowland parts of the region belong climatically to the humid subtropics (Köppen's Cfa). Temperature contrasts between various parts are not conspicuous, the whole littoral of Japan south of latitudes 35° or 36° having summer month temperatures varying between 75°F. and 78°F. and winter months averaging in the neighborhood of 40°F. A frost free season of 200-240± days is characteristic. The most conspicuous regional climatic contrasts are concerned with cloudiness and precipitation, the Sanin or Japan Sea littoral of northern Chugoku differing from the Inland Sea borderlands in having more winter precipitation and cloud, with snow lying on the ground in winter several centimeters deep. Brighter, clearer winters with no snow cover, and a total annual precipitation of only 40-50 inches concentrated in summer typify Inland Sea conditions. Subtropical broad-leafed evergreen forests, similar to those of lowland Chubu, were characteristic. In northern

Kyushu is the one locality of significant mineral wealth, the largest part of the nation's coal coming from that region.

More than any other section of Japan, that part of the Inner Zone within the basin of Setouchi (Inland Sea) is the heart of Old Japan. As a result of the long tenure, relict occupance forms are abundant. The two ancient capitals, Nara and Kyoto, which from 710 to 1192 were the centers of national government, still bear in their temples, shrines, and palaces evidences of imperial occupance. Considering the small area of low lying tillable land, population is denser than in most parts of Japan although due to almost an entire lack of extensive plains there are few conspicuously large clusters of concentration on the demographic map. It is on the lowlands of Kinki at the eastern end of Setouchi, where Osaka, Kyoto and Kobe, three of the nation's six great cities, are located, that population concentration is most distinct. As a corollary of the dense rural population, land holdings are small, averaging less than 2 acres for many of the prefectures.[76] Artificial terracing of the hillsides to permit of their agricultural utilization is widely practiced and is one of the rural landscape features which is a source of amazement and wonder to an American. Paddy fields are commonly winter cropped. As along the warm, sunny, Sun-en coast, so also here, tea, citrus and mulberry are conspicuous on the hill slopes and diluvial terraces.

Within the borders of the Inner Zone are included the southwestern half of Japan's industrial belt, containing two important nodes of concentration, the Osaka-Kobe-Kyoto center, of first rank in Nippon, and the North Kyushu region, specialized in heavy manufactures. Transpacific and round-the-world boats all touch at Kobe, the nation's first port, using the Inland Sea as the most direct route to and from the Asiatic mainland. It is the northern Chugoku or Sanin coast which in most respects is not in harmony with the preceding description, for, isolated as it is, great industrial and urban centers have not developed there, and the general refinements of civilization are less advanced.

[76] In Hiroshima prefecture 168,824 out of the 192,473 agricultural households cultivate less than 2½ acres, while 101,428 cultivate less than 1¼ acres.

Subdivisions of the Inner Zone

Region 1. Kinki or Eastern Setouchi[77]

Semi-isolated alluvial-filled grabens and associated hill lands of horst structure are characteristic of Kinki.

1a. The Hilly Uplands. (1a[1] *Omi-Iga,* 1a[2] *Ikoma, and* 1a[3] *Izumi*).—Lying between the Nobi Plain on the east and the Kyoto and Nara (Yamato) Basins on the west, and bounded by fault scarps on both margins, the Omi-Iga upland is composed of tilted blocks and true horsts which have been reduced to complicated hill country by stream erosion. Along the eastern margins there are some summit elevations which exceed 1,000 meters but much the larger part of it is little more than half that height. Granite is the predominant rock so that rounded cupola forms and bare whitish hills with a veneer of loose rock waste, imperfectly covered with vegetation, are characteristic. Where there are Tertiary rocks, elevations are lower and the drainage net much finer. Population is relatively dense for a hilly country, villages as well as dispersed farmsteads crowding the valleys and the small fault basins. Pond irrigation is widely practiced.

The Ikoma Hills separating the Nara Basin from the Osaka Plain, and the Izumi Horst between the latter lowland and the Kino Graben are similar in most respects to the Omi-Iga hills.

1b. The Fault Basins.—1b[1] *Biwa (Omi) Basin.*—This largest of the Kinki depressed areas, containing the most extensive fresh-water lake in Nippon, provides the narrowest and most complete break in the mountain walls of Honshu which separate the Pacific from the Japan-Sea coasts. A narrow ridge of hills, some 9-10 miles wide, cut by numerous north-south fault valleys, is all that separates the Omi Basin from the deep tectonic indentations of Wakasa Bay on the north coast. In ancient days this was the site of a barrier-gate comparable to the one on the Tokkaido. A still narrower and lower mass of hills, 2 to 3 miles wide, forms the southern divide which sep-

[77] Summer W. Cushing: Coastal Plains and Block Mountains in Japan, *Annals of the Asso. of Amer. Geog.* III, 1913, pp. 43-61. See also; Kyoto, Nara, Osaka, Kobe, Guidebook Excursion D, Pan-Pacific Science Congress, Japan, 1926.

arates the Omi and from the Yamashiro (Kyoto) Basin. From ancient down to modern times this corridor between north and south coasts has been an important transit route used for both military and commercial purposes, and is followed today by the Hokuroku, and in part by the Tokkaido, railroads, which negotiate the northern and southern barriers by means of tunnels. It is by this natural route that the Japan-Sea coast of Chubu is made tributary to the industrial and port cities of Osaka, Kobe and Nagoya.

The asymmetrical basin occupied by Lake Biwa has higher and more precipitous walls on the west than on the east, with the result that the alluvial and diluvial fringe surrounding the lake is much narrower, and the individual fans steeper, on the western margin where the waters are also deeper. The shoreline is definitely scalloped by the numerous advancing fronts of convex delta-fans which the radial drainage lines are producing. On the eastern margins a few hard-rock outliers rise above the alluvium or out of the shallow water. Within the Biwa area, and for Kinki as a whole, three distinct depositional forms are recognized, (1) the delta-fans of new alluvium, those along the eastern margins of the lake being broader and flatter, (2) the lower and younger, and (3) the higher and older, diluvial terraces.[78] The latter are composed chiefly of coarse fluvial deposits with some intervening clay beds, the total thickness often being over 100 meters. Where gravels predominate the surfaces are likely to be rugged, exhibiting bad land characteristics, although level to undulating crests are also represented. Unlike the Shizuoka terraces these of Omi unfortunately have no mantle of volcanic ash. The lower terraces which represent a second stage of uplift, have smoother surfaces and finer, better mixed soils with less sand and gravel. Elevated streams, flanked by high dikes, their beds 20 feet or more above the alluvial lowlands, are characteristic of the delta-fans. In some instances railroads and highways are carried under the river beds by tunnels rather than over them by bridges. Thick groves of bamboo characteristically parallel the river courses, their roots serving to hold the levees in time of flood. Ruthless cutting of the timber from the surrounding granite hills to sup-

[78] *Ibid.* See especially geological map of Kinki in guidebook.

ply wood for the rebuilding of the Buddhist temples of Hieh, and for the great urban centers of Kinki, early led to disastrous floods and associated deposits of sand and gravel on the fertile plains below. It was here in the Biwa Basin that some of the first work of torrent correction was begun under the direction of a Dutch engineer in 1871, but even yet bare whitish granite slopes are conspicuous.

Climatically the basin subdivides into two parts, a northern half (down to about the Aichi River) which is similar to the Hokuroku Coast of Chubu, and a southern half which is similar to the Pacific side of southwestern Japan. In winter especially is the contrast marked, for at that time the strong winter monsoon blows over the low range of intervening hills into the northern end of the Omi Depression, giving gray, overcast, snowy weather, typical of Japan's windward coasts in that season. During the three winter months precipitation near the southern end of the lake is not much more than one half what it is along the northern margins only 35 to 40 miles distant where snow lies deep on the ground.

This climatic division leads to major contrasts in culture as well, for while in the southern half of Omi Basin most of the rice fields are winter-cropped, being resown to wheat, barley and rape in fall, those in the snowier north remain fallow after the rice harvest. In northern Biwa, as along the Japan Sea Coast, are to be seen along the paddy-field margins the rows of bare upright poles, or slim, almost branchless trees, upon which the rice straw is hung to dry. The low terraces are somewhat less completely utilized than the new alluvium but nevertheless bear important crops of rice, mulberry, summer vegetables, and winter grain, as well as some tea. In such locations pond irrigation is common. The ruddy colored high terraces, as well as the steeper, stonier upper parts of the alluvial fans, have much waste land and woodland. Where dissection of the high terraces has been relatively complete, a complicated pattern of cropped land is frequently coincident with the intricate valley system, terraced paddies watered from ponds being conspicuous. Bamboo is relatively abundant, and in favorable locations, even on the level crests of these higher uplands, some dry crops are cultivated.

The lake itself, together with its rugged, hilly "umland", and the legend, history and art which are associated with its classic shores, make the Biwa region attractive to resorters, tourists and sightseeing groups from the adjacent metropolitan centers. Two funicular railways carry tourists to the top of Mt. Hieh, where among the magnificent cryptomeria are famous ancient Buddhist temples, and from which elevation of 2,800 feet one beholds a panorama of almost the entire Biwa Basin and of Kyoto as well. Small tourist boats, carrying some freight, ply between various towns along the lake shore. Biwa is well stocked with fish and although most of the catch is consumed by the local population, some is sent to the adjacent cities. Crude arrow-shaped bamboo-and-reed fish traps are conspicuous in the coastal waters. By way of the Seta River at the extreme south, Biwa's waters find their only natural outlet, although two parallel canals, carried by tunnels through the intervening hill-barrier, connect the lake with Kyoto, one providing that city with its water supply, the other a carrier of trade.

Although Omi Basin is not a focus for large-scale manufacturing, industries are not absent. Until recently at least the weaving of various kinds of cloth for the Japanese market has held first rank, but this position of the weaving industry may now have been lost through the erection of several large rayon factories at the south end of Biwa in the vicinity of Otsu and Zeze. The location is favorable for rayon factories, because of the large amount of clean soft water which is readily available, and because of proximity to the ports of Kobe and Osaka through which the pulp is imported.

1b[2]. *Yamato or Nara Basin.*[79]—In gross morphology Nara is similar to other Kinki basins, the floor being composed of flat-lying new alluvium with marginal fragments of both young and old diluvial terrace, the latter being much more abundant. In materials and forms the diluvium of Yamato resembles that of Biwa. A belt of dissected high terrace, known as the Nara Hills, forms the boundary between the Yamato and Kyoto Plains. Population is extremely dense even for Japan, 70 per

[79] This subdivision has been studied in detail by Robert Burnett Hall. See his published study, The Yamato Basin, Japan: *Annals of the Association of American Geographers*, vol. 22, 1932, pp. 243-291.

cent of the people living in small rectangular rural villages, hedge and sometimes moat-enclosed. Following the "Handen" system of land partition introduced from China prior to the seventh century, the land was divided and subdivided into rectangular plots, all boundary lines being north-south and east-west. Villages were planted at rather regular intervals, drainage lines were brought into conformance with the rectangular land subdivisions, literally thousands of small irrigation ponds only a fraction of an acre in size were dug, so that the entire landscape has taken on a distinct checker-board aspect. Although not confined to Yamato, this Handen system with its evenly-spaced compact villages being found throughout lowland Kinki and other parts of southwestern Japan as well, it seems to exist there in the most exclusive and least-altered form.

On the higher parts of the basin floor where drainage is more perfect, 72 per cent of the land is replanted to winter crops while 10 per cent yields three crops.[80] At lower elevations, because of inadequate drainage, most of the paddy fields lie fallow in winter. The larger part of the old diluvium has been left in trees and waste, much more of the lower, smoother, new diluvial terraces being cultivated, both irrigated rice and dry crops (watermelons, mulberry, vegetables, tea, persimmons and oranges) being common. The amazing thing is that in such a long occupied and densely peopled region, more complete utilization, at least of the low terraces, has not been accomplished.

Nara City (53,000), the metropolis of the basin, and the first permanent capital of Japan (710-784 A.D.) is a hallowed spot, famed not only for its ancient temples and other antiquities, but for its natural beauties as well. In 1930, 3,000,000 pilgrims and tourists visited the city.[81] An excellent foreign-style hotel caters to occidental visitors.

1b[3]. *Kyoto (Yamashiro) Basin.*—Separated from Nara and Osaka Plains only by narrow belts of old diluvial terrace, Kyoto Basin is like Nara in many of its natural and occupance features. In the central eastern part shallow swampy Ogura

[80] *Ibid.*, p. 267-268.
[81] *Ibid.*, p. 287.

Lake, remnant of a larger body of fresh water which at one time occupied the entire lowland, is rapidly being reclaimed for rice fields. Conspicuous along the river courses as well as on the bordering terraces are the groves of bamboo. Along the eastern margins of the plain are extensive orchards of Japanese pears, their branches and fruit supported on horizontal trellises. On the diluvium in the vicinity of Uji, between Kyoto and Nara, tea gardens are abundant, this region being famed throughout Japan for teas of extraordinary quality. The Handen system of land partition has left an indelible imprint upon the rural landscape, more especially in the rectangular arrangement of its culture features.

Kyoto, (765,000) one of Japan's six great cities, and the site of imperial residence for close to eleven centuries (to 1869), still retains its imperial grandeur and beauty. A charm of refinement, culture, and quietness pervades it, for it is scarcely a part of modern manufactural Japan, the industrial revolution having largely passed it by. During the feudal period it developed as a handicraft center for such products as lacquer, porcelain, bamboo, cloisonne, bronze, and silk textiles. Its present-day industry is a survival of these feudal predecessors so that large factories are absent, in fact they are excluded by law. Not being a sea-coast town and without the advantages of water transport, (although it is on the Tokkaido railway) Kyoto has not evolved industrially along with the port cities of Osaka, Nagoya, Tokyo, Kobe and Yokohama. It is still a city of craftsmen, catering to a wealthy Japanese and foreign tourist trade. Foremost among its workshop industries is textile manufacturing—dyeing, bleaching, weaving silk cloth, twisting silk thread—but 80 per cent of the cloth dyed and bleached in Kyoto is woven outside of the city.[82] Like Nara, Kyoto is a pilgrimage and tourist center, for the environs of the city are classic ground upon which 1,500 years of Japanese history have run their course. The old Imperial Palace, ancient and famous Buddhist temples and monasteries, the mausoleum of Emperor Meiji—these are only a few of the revered spots which attract foreigners and Japanese alike. The city stands at the extreme northern end of Yamashiro Basin under the shadows of the

[82] Orchard, *op. cit.*, p. 151-154.

surrounding hills, on a somewhat higher portion of the alluvial floor where streams debouch onto the plain. Its rectangular outline, as well as the grid arrangement of its north-south and east-west streets, indicates Handen influence. Kyoto is more distinctly Japanese in its features than either of the other five great cities, although in the commercial nucleus occidental-style structures are not uncommon.

1b[4]. *Osaka or Settsu Plain.*—Larger than Nara or Kyoto Basins, but like them in having an alluvial floor with borderlands of both old and new diluvium, Osaka Plain has the outstanding advantage of fronting on tide-water. Essentially it is the advancing bay-head delta of the broad and diked Yodo River and its numerous distributaries, with amphibious ocean margins and shallow water offshore. Although Handen influence is discernable in settlement forms and land subdivision, it is not dominant. Population is exceedingly dense. Myriads of irrigation ponds dot the diluvial borderlands with some on the alluvial floor of the plain as well. A relatively wide and con-

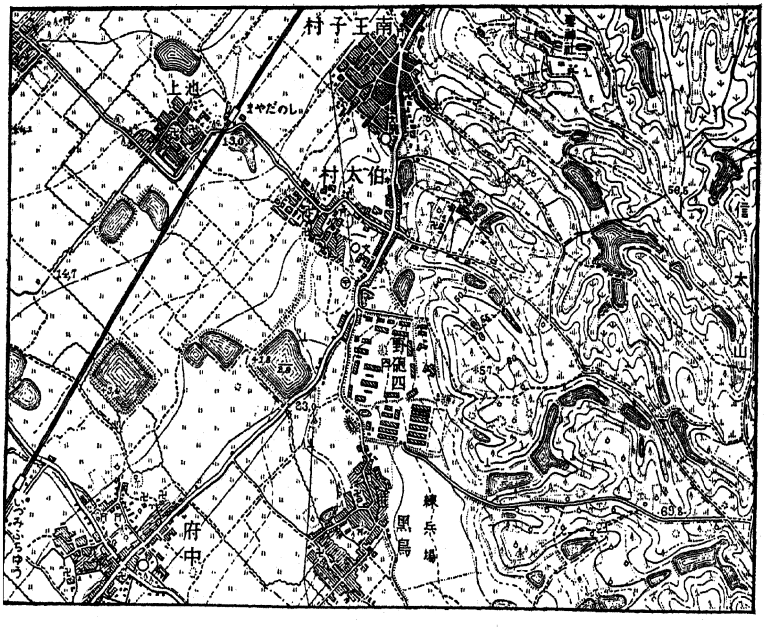


FIG. 41.—A section of the lowland at the head of Osaka Bay showing both high and low terrace. Irrigation ponds are conspicuous on both terraces, rice occupying much of the lower terrace and the valleys of higher dissected one as well. Orange groves are conspicuous on the slopes of the latter. Scale 1:25,000.

tinuous belt of diluvial terrace borders Osaka Bay on the south and east. In places the terrace reaches the waters edge and terminates in low wave-cut cliffs. Toward the north and approaching Osaka, the diluvial bench lies somewhat inland so that there is a wider sandy beach principally devoted to vegetable culture, between the sea and the terrace. Much of the smooth rolling surface of the low diluvium is in rice, vegetables and other dry crops, while the belt of higher and more dissected diluvium farther back from the coast is a specialized orange growing region with rice occupying the maze of intricate valleys. To be sure woodland and wasteland dominate, but cultivation seems to be more general than on most of the old terraces of Kinki.

Here on the Osaka Plain at the eastern end of Setouchi is Japan's industrial node of first rank. While principally focused at Osaka City, manufacturing plants, forming a somewhat attenuated crescentic industrial belt, occupy coastal locations along the margins of Osaka Bay from Kobe on the northwest to beyond Kishwada on the southeast, with Kobe, Sakai and Kishiwada as the principal secondary nodes. The region has no power or raw-material advantages; its location on tidewater, served by lighters and rail from Kobe and Osaka as foreign-trade ports, and in a densely populated region where labor is relatively abundant, must be classed as its major benefits.

In no other part of the country are transportation facilities as excellent and well developed. Within this general Osaka-Kobe-Kyoto industrial area are included 25 per cent of the factory workers of Japan and 38.4 per cent of the cotton spindles, while in 1924 this area produced 32 per cent of the nation's total value of manufactured goods.[83] A great variety of industries is characteristic but with the cotton textiles standing out above all others. Of the major industries, only the smelting of metals and the reeling of silk are not well represented.

Osaka City (2,454,000) at the head of shallow Osaka Bay, where along a coastal strip of 20 kilometers a score or more streams debouch, is located on the Yodogawa Delta, whose projecting front creates the principal irregularity of the otherwise crescentic littoral. Much the larger part of the city is built on flat delta sediments, only slightly above sea level, so that large mod-

[83] Orchard, Japan's Economic Position, *op. cit.*, p. 134.

ern buildings must be supported on wooden piles or metal drums. Throughout this section Osaka is intersected by a remarkable network of rivers and canals; a veritable Venice with over 1,600 bridges. Only along the city's extreme eastern margin are the site conditions different. Here residential forms occupy a north-south spur of diluvial terrace, 1 to 2½ kilometers broad and 10 to 20 meters high. As its northern tip (now the northeast corner of the city) which descends abruptly to the lowland and from which strategic site one commands a view of the entire city and its environs, are the remains of one of Japan's greatest feudal castles. Its wall and moat-en-

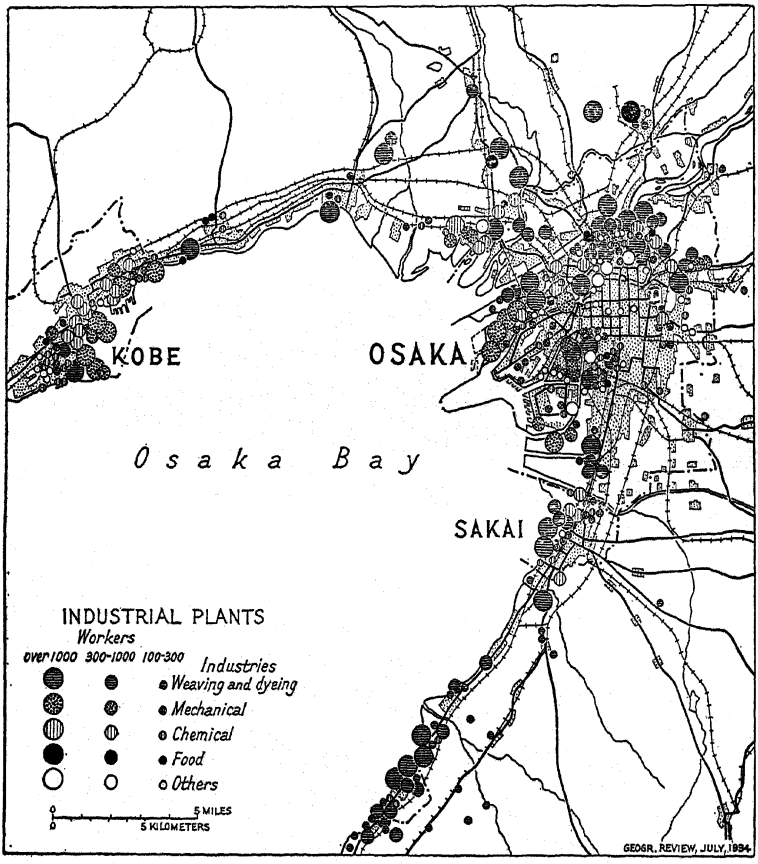


FIG. 42.—(Plate loaned by the Geographical Review published by the American Geographical Society of New York.)

circled grounds are now occupied by permanent army barracks. From the old heart of the city, at present some 5 kilometers from the delta front, a relatively narrow belt of urbanized land extends southwestward between the Ajikawa and Shirinashi channels, following the principal lines of communication connecting the city proper with its harbor.

Only in Kyoto is the grid pattern of intersecting north-south and east-west streets more extensively developed than in Osaka. It is in the newer western part that departure from this pattern is most marked. Most of the streets are still typically Japanese in their widths although several of the great thoroughfares have been widened to 20 to 25 meters. There has been no recent earthquake and resulting fire as in Tokyo to permit of a thorough remodeling of the city structure. Throughout the business core however, which is close to the geographical center of the city, occidental structures predominate to a greater degree than in any other Japanese city, and this in spite of the fact that Osaka has almost no foreign residents. The large and relatively tall buildings and the traffic-crowded streets cause an American traveler to feel much at home. Nevertheless the numerous narrow streets and bridges are a severe handicap to fast-moving traffic. Shallow canals in rectangular pattern intersect the business section providing a convenient way of receiving the necessary commodities. The best and most exclusive residential areas are on the diluvium at the eastern margins of the city, and along the coast toward Kobe. Manufactural Osaka encircles the older part of the city on the north and west and is served by numerous deep-water canals and distributary channels. Mecking estimates that one third of the urban area is primarily manufactural.

Osaka's commercial and industrial preëminence is of long standing. During a considerable part of the fourth century A.D. it was the capital city of Japan and consequently the political as well as the economic center. During the long Nara-Kyoto period of political preëminence Osaka (then called Naniwa) was their principal port, and commercial and financial center. Very early it became the port of entry for official envoys from Korea and China. In the 16th century Hideyoshi, predecessor of the Tokugawa shoguns and one of the greatest tycoons

of the feudal period, chose the city for his residence, built Osaka castle, and induced the merchants of Sakai and Fushimi to locate there. Throughout the whole feudal period, even after Yedo (Tokyo) became the Tokugawa capital, Osaka continued to grow as a commercial center, the daimyos erecting huge warehouses there for the storage of the products from their respective fiefs. Osaka merchants acted as middlemen and bankers in the distribution of these products so that their city became the commercial hub and they the merchant princes of the country. Kyoto, site of Imperial residence, and a city of 1,000,000 throughout much of the feudal period, required tremendous quantities of supplies, all of which passed through its port, Osaka, only 27 miles distant. Thus at the time Japan was opened to foreign trade three quarters of a century ago, Osaka was the greatest trading mart in the country, but it was all domestic trade carried on in shallow, clumsy junks, and requiring little in the way of port facilities. In 1868 the city was opened to foreign trade, but due to the shallow and generally unimproved harbor, the large foreign boats engaged in deep-sea commerce could not enter and Osaka's business suffered. It was at this time that Kobe, 16 miles down the bay on deep water rapidly grew into prominence as the trans-shipping port for foreign cargoes. Even today, in spite of extensive improvements, the large transpacific boats are unable to enter Osaka harbor although it is now the third ranking port in foreign trade.

Modern Osaka harbor is entirely of artificial construction. Two converging moles extending seaward some 3 kilometers, with a narrow entrance between their terminals, enclose a harbor which has been dredged to a maximum depth of 9 meters at low water. Thirty-one anchor buoys provide facilities for the berthing of vessels up to 20,000 tons, while piers and quays can accommodate smaller boats of not over 6,000 tons.[84] Private and municipal warehouses line the waterfront. The Shirinashigawa and Ajikawa debouch within the harbor and these waterways provide entrance not only for lighters, but also for cargo boats of 3,000 to 4,000 tons into the industrial

[84] *The Port of Osaka.* Compiled and Issued by the Municipal Harbor Department, Osaka, Japan, 1930.

heart of the city, where they can unload at the quays of the manufacturing plants.

Considering domestic as well as foreign trade, Osaka is even yet the greatest port of Japan, although its foreign commerce is still much smaller than either Kobe's or Yokohama's. In 1929 the total value of foreign merchandise handled was only 57 per cent of the value of its domestic trade. Although it is the greatest consuming center in Japan, a large part of the raw wool, cotton, iron and steel and machinery destined for Osaka is unloaded at the deepwater port of Kobe and lightered to Osaka thus arriving at the port as domestic commerce. Tramp rather than line traffic still predominates. Exports considerably exceed imports for while the bulky industrial raw materials from Australia, India and the United States, are commonly brought by large steamers and consequently unloaded at Kobe, the exported finished products on the other hand are destined principally for Asiatic markets, chiefly Chinese, and are carried in smaller boats, many leaving directly from Osaka.

COMPOSITION OF THE FOREIGN TRADE OF OSAKA, 1929*
(in yen)

Exports		Imports	
Cotton cloth and clothing	286,212,000	Ginned cotton	82,451,000
Cotton yarn	21,447,000	Lumber	30,758,000
Iron and steel manufactures	11,639,000	Wool	16,823,000
Paper	10,251,000	Pig iron and iron products	24,728,000
Glass and porcelain ware	8,673,000	Automobiles and accessories	9,030,000
Silk cloth (including cotton mixtures)	9,079,000	Sugar	4,163,000
Industrial machines and accesories	5,348,000	Woolen yarn and cloth	5,771,000
Brass and yellow metal	8,330,000	Coal	8,485,000
Sugar and confectionery	2,756,000	Seeds	12,261,000
Woolen yarn and cloth	3,653,000	Zinc	6,193,000
Total (including miscellaneous)	444,948,000	Total (including miscellaneous)	317,316,000

* In 1931 exports amounted to 218,914,000 yen, and imports 215,786,000 yen.

As previously stated, Osaka, Japan's greatest manufacturing center, is only the principal hub of a local industrial region, restricted to the Settsu Plain, which includes not only the two other lesser centers, Sakai and Kishiwada, but also numerous

small cities and villages in the general vicinity. In the suburban villages it is the lighter industries, such as the processing of paper products or wooden wares, and the weaving of cloth, which can be housed in domestic workshops or small factories, that predominate. Sakai and Kishiwada reflect the predominance of textiles in the manufacturing set-up of the general region, those cities being especially important as cotton spinning and weaving, and bleaching and dyeing centers, chemical manufactures being regionally associated with the latter industries. One notices the strong discoloration of the streams in the vicinity, resulting from waste issuing from the dyeing plants along their banks. A great variety of manufactures of about equal importance characterize Osaka City's industrial set-up, with only one, cotton spinning, typically housed in large factories, standing out above all the others. However, among the great *general classes* of industry, two, textiles and metals, both classes including a large variety of products, predominate.[85] Ten per cent of the cotton spindles of Japan are within the municipal boundaries, while 21 per cent are included within the general Settsu industrial region.[86] Cotton weaving is of little importance in Osaka City, although the lowland on which it stands is the country's foremost center, the common unit of production being small workshops located in adjacent towns and villages. The compact nature of both the raw material and the finished product, as well as the small need for a large unit of labor, make village location more economical. In a very real sense the spinning industry of Osaka and the weaving industry of its "umland" are interdependent and complementary in nature. In addition to cotton spinning, the dyeing and bleaching establishments, and plants for the manufacture of knit goods, woolens and woolen mixtures, are well represented. Silk reeling and spinning seem to be the only phase of textile manufacture not present.

In spite of the fact that there are no blast furnaces in Osaka the fabrication of metal products is a major industry. Imported domestic and foreign pig iron are converted into steel in two important steel plants using imported domestic coal.

[85] Of the employees in Osaka's 5,676 factories (with over five workers) in 1930, 24.8 per cent were in spinning mills, 18.1 per cent in machine factories, 16.1 in metallurgical industries and 11 per cent in chemical plants.

[86] Orchard, *op. cit.*, p. 140.

Very emphatically it is the large local market for such items as industrial machinery, electrical apparatus and hardware that has stimulated this specialization in metals. Bridges and structural steel, marine engines, and railway equipment are additional metallic products of more than local importance. Although overshadowed by Kobe as a boat building center, largely because of the deeper water at that port which permits the launching of large vessels, Osaka turns out a relatively large number of smaller boats. A host of other industries, including chemicals, printing and book binding, wooden and bamboo wares, bicycles, food and drink products, bring the total number of manufacturing establishments within the city up to over 30,000 of which however, only 5,676 employ more than 5 operatives.[87] In spite of the predominance of small plants, large and conspicuous factories are more numerous here than in any of the other principal manufacturing centers. These features, together with the smoky, murky atmosphere and the filthy waters of canals and streams fouled by the factory debris which line their banks, give to Osaka a thoroughly industrial aspect.

On first thought the reasons for Osaka's industrial preëminence may not be so obvious. Without coal or notable raw materials within its immediate "umland", two of the most conspicuous advantages for manufacturing are absent.[88] It is rather, (1) the wide expanse of level land on which the city is located providing adequate room for city growth and industrial expansion, (2) the adequate facilities for water transport both within and without (through Kobe and Osaka harbors) the city, making it accessible to bulky fuel and raw materials, and (3) the large supply of available labor and capital, the latter first accumulated by merchant families during the feudal period, that have favored the centering of industry at Osaka. To these above suggestions should be added Osaka's excellent rail facilities, for it is the hub of a wide-spread rail net which taps an extensive and densely populated hinterland.

Kobe (787,000), on deep water, 16 miles down the bay from Osaka is a new Japanese city having been brought into existence

[87] Japan year Book, 1933.
[88] To a much greater degree than the Tokyo-Yokohama industrial region, Osaka and vicinity depend directly or indirectly upon coal rather than upon hydro-electricity as a source of power.

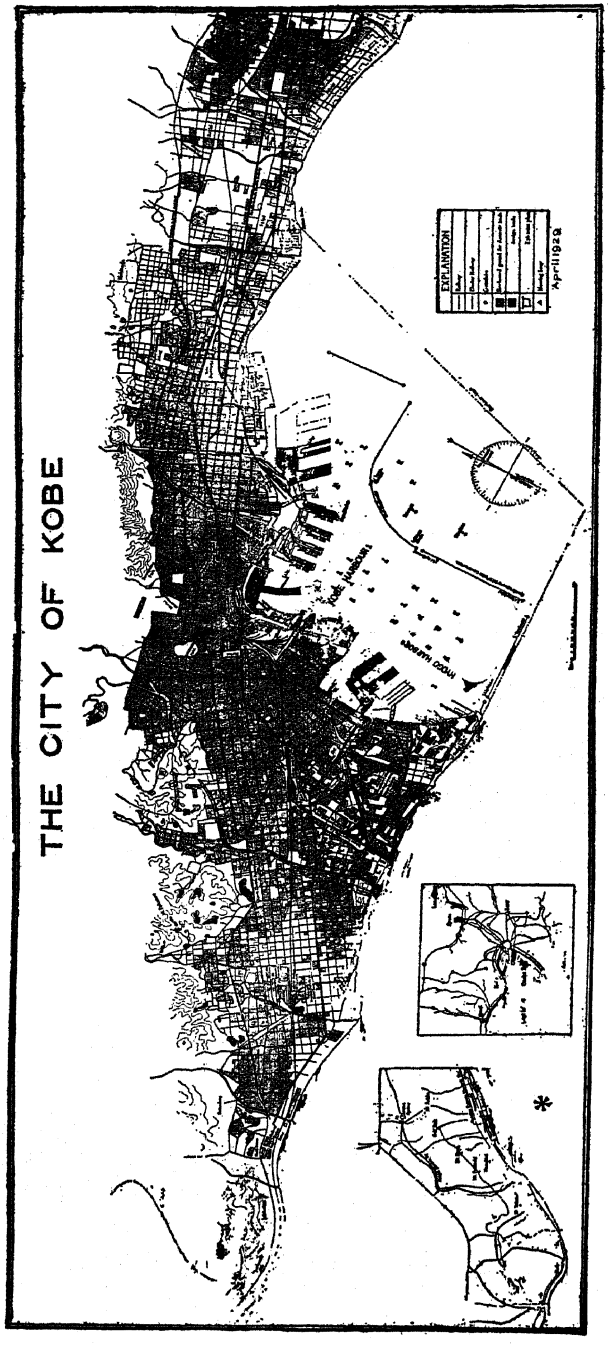


FIG. 43.—Kobe, the principal deep-water port of the Kinki settlement area.

by the demands of the modern commercial and industrial era. In that respect it is like its rival deep-water port, Yokohama. When, after the middle of the last century, Japan was opened to foreign trade the present site of Kobe harbor was occupied by only insignificant fishing villages. Hyogo harbor, south of the Minato Delta, and now a part of expanded Kobe City, was to be sure for several hundred years prior to The Restoration an important settlement and port city, profiting by its proximity to the flourishing metropolis of Osaka. Osaka's shallow harbor being unable to admit large foreign vessels made necessary an adjacent deep-water port to serve the general Kinki region and it was on the slight coastal indentation known as Kobe Bay, 16 miles distant from Osaka, that such a development took place, which is now the nation's foremost port. At present it is the fourth city of Japan in size, only Tokyo, Osaka and Nagoya exceeding it in population. The port and modern city were to a considerable degree developed by British and American merchants and even today foreign concerns are relatively more important there than in any other city, the non-Japanese population being over 12,000.

The site of Kobe, a narrow coastal and piedmont strip, backed by a high and precipitous granite horst, has determined its linear shape (12 kilometers long by 1½ to 2 kilometers broad). Its immediate hinterland is barren of settlement which again serves to emphasize the fact that Kobe's *raison d'etre* is the populous Kinki region, and more especially industrial Osaka. The industrial and commercial sections of the city occupy the flatter land along the waterfront while residential Kobe is on the piedmont slopes to the rear. The retail commercial core, much of it emphatically occidental in appearance, occupies a mid-position along the coast just back of the principal piers, dividing the industrial strip into eastern and western parts. Portions of the city along the waterfront are built upon reclaimed land, the larger buildings resting upon wooden piles. Since all parts of the business and industrial section are so near salt water, no extensive system of canals such as serves most of the great Japanese cities, is necessary in Kobe.

Primarily commercial, and somewhat overshadowed industrially by the adjacent metropolis of Osaka, Kobe is nevertheless a relatively important manufacturing center. Metal in-

dustries, and particularly ship building, stand out above all others, the large Mitsubishi and Kawasaki yards, conspicuous as one enters the harbor, being capable of fabricating the largest transpacific boats as well as war vessels. Thus Osaka Bay region, with both Kobe and Osaka as foci, is Japan's ship building center of first rank. Deep, quiet, water appears to be its principal advantage, for both fuel and materials must be shipped from the iron-smelting region of North Kyushu. Associated with the shipyards are steel converters, machine and tool shops, and steel products subdivisions. Other than metals, there are also plants of conspicuous size manufacturing matches, bean oil and cake, rubber goods, flour, sugar, and cotton thread. All of these profit by Kobe's preëminence as a port city, it being the terminus of many of the Japanese shipping lines. Although in the midst of a textile area, and surrounded by smaller cities containing both spinning and weaving mills, Kobe is not a textile center, having but one large spinning mill. The lack of available level land within the city for factory sites is a genuine handicap to industrial expansion.

Kobe's position as the ranking port of Japan is definitely associated with two items of location; (1) its Kinki hinterland, the most populous, urbanized and industrial region of the country, and (2) its location on the famous Inland Sea steamship route followed by boats operating between Asia and North America. It has as a consequence, become the terminus for much of the Japanese line-traffic and a port of call for all foreign line boats operating in East Asian waters. Large mail and passenger vessels berth alongside the piers to unload; freighters more frequently adopt the less expensive procedure of anchoring at buoys where they are serviced by lighters. That Kobe is an industrial port serving the Osaka-Nagoya hinterland is testified to by the character and volume of the ocean freight flowing through it, imports exceeding exports emphatically in volume and even slightly in value. Raw cotton for Kinki's greatest industry comprises 42 per cent of the imports. Among the export commodities raw silk holds first position (30 per cent) with cotton textiles (23 per cent) the other single large item.[89] Until Yokohama was demolished by the earthquake and fire of 1923 that port held almost a monopoly of the raw silk trade.

[89] Figures are for 1929.

Profiting by its rival's misfortune, Kobe at that time took, and has continued to retain, a considerable proportion of that silk trade from those regions in western and southern Japan which are naturally tributary to it. Kobe's position as a commercial city being so thoroughly dependent upon the Kinki industrial hinterland, Osaka's and to a less degree Nagoya's program of harbor improvement, and their growing importance as ports, are sources of some concern to Kobe. At present ocean freight rates to Osaka and Kobe are identical even though transshipment is necessary to the former. Consequently, if Osaka harbor is ultimately improved to such a degree as to admit large ocean steamers, Kobe will necessarily suffer since its own local industrial hinterland is limited. Kobe's principal trade is with Eastern and Southern Asia, the United States being a close second. Unlike the situation at Osaka, water-borne domestic trade is less important at Kobe than foreign trade, amounting to only 70 per cent of the latter. A large part of this is lighter traffic with Osaka or by small steamers or sailers with the local ports of the Inland Sea for which Kobe acts in the capacity of an entrepôt.

COMPOSITION OF THE FOREIGN TRADE OF KOBE, 1929*

Imports ~~Exports~~ (in yen)		Exports ~~Imports~~	
Raw cotton	391,821,000	Raw silk	207,561,000
Machinery	46,878,000	Cotton textiles	159,000,000
Wool	31,832,000	Silk fabrics	81,820,000
Crude rubber	23,618,000	Hosiery	23,869,000
Sulphate of ammonia	19,160,000		
Woolen yarn	16,683,000	Total (including miscellaneous)	701,893,000
Jute, flax, and hemp	16,012,000		
Beans and bean cake	29,916,000		
Wheat	11,253,000		
Pig iron and iron products	36,894,000		
Total (including miscellaneous)	882,331,000		

* In 1931 exports amounted to 409,011,000 yen and imports 457,740,000 yen.

1b[5]. *Kino Graben* is a narrow spear-shaped, waste-filled valley lying between the Izumi Horst on the north and the Kii Folded Mountains on the south, and coinciding with the great fracture zone and morphological fault which separates the Inner and Outer Zones of Southwestern Japan. Diluvial deposits carved by river erosion into a succession of terraces represent-

ing different stages of uplift, fill the northern part of the valley, the river and its narrow alluvial flood plain being crowded against the hardrock hills on the south. Rice predominates on the alluvial floor. Both smooth and dissected terraces are represented, on these elevated sites general dry crops as well as mandarin orange groves, mulberry, and woodland being relatively conspicuous, although pond-irrigated rice also competes for space. The north-facing hill slopes bordering the south side of the graben have even a greater concentration of orange groves than do the terraces on the north side, this Kino Valley being a part of that specialized Kinki orange district lying along the south side of Osaka Bay and Kii Channel. Wakayama City, (117,000) at the mouth of the valley, and an outlier of the Osaka industrial belt, is specialized in spinning, weaving, dyeing and bleaching of cotton and silk fabrics. Wakanoura, on a small indentation about 5 km. south of Wakayama is that city's port. Depths of 2½ meters are maintained so that small boats engaged in domestic trade can enter with cargoes of coal and raw cotton and carry away lumber, fish, oranges and straw materials.[90]

Region 2. Central Setouchi (Inland Sea)[91]

In the various schemes for subdividing Japan geographically, Setouchi is almost invariably recognized as a unit. It is Japan's Mediterranean. Literally translated the word Setouchi means "within the channels", referring to the straits, all of them fortified zones, which connect the Inland Sea with the open ocean. Morphologically it is the lowest part of a subsiding land area which had been a maturely dissected peneplaned surface cut by a complicated net of faults. Its archipelagic character, exceedingly irregular coast line of cala type, centripetal drainage, and relatively bright, dry sunny climate, together with its borderlands of partially bare granitic hills, give to Setouchi Basin a considerable degree of physical similarity.[92] Its waters

[90] Mecking: Japan's Häfen, *op. cit.*, p. 423-425.

[91] H. Schmitthenner: *Die Japanische Inlandsee,* Hettner-Festschrift. I. Watanuki: Geography of Setouchi with One Hundred Illustrations (in Japanese), Tokyo, 1932. Keiji Tanaka: *Some Geographical Notes on the Excursion to the Inland Sea (Setouchi) Region, Including Miyajima* (unpublished).

[92] The Besshi Copper Mine and Yashima, Guide-Book, Excursion E-2, Pan-Pacific Science Congress, Japan, 1926, pp. 2-3.

are shallow so that an uplift of 50 meters would expose a land surface in essential features like the lands now bordering its shores. Before submergence the region was a series of five large basins separated by dissected horsts—quite analagous to the inland basins of Kinki. These basins are now the more open portions of Setouchi, called "nadas". The archipelagic portions, composed of hundreds of islands arranged in roughly parallel rows, are the exposed crests of the intervening dissected horsts, while the narrow channels between the islands mark the fault lines. At present the deepest water is found not in the open nadas, but in the constricted interisland channels, their depths being maintained by tidal scouring, tidal races being so vigorous in places as to make navigation difficult if not actually dangerous.

Fortunate are those Japanese who reside along the shores of Setouchi for the charm of its subdued landscape marks it as one of the lovliest parts of Nippon. From its long occupance and the number of people who have crowded on to its diminutive plains and adjacent hill slopes, it would appear as though the attractiveness had been effective. Clear blue skies and waters, the latter calm and island dotted, picturesque fishing craft, shining sandy beaches of decomposed granite and small carefully cultivated plains with closely spaced settlements, back of which rise several hundred feet of artificially terraced and cultivated slopes—all of these are ingredients of the Setouchi landscape. Probably in no other large area of Japan is cultivation of steep slopes so extensively practiced.

The quiet waters, and numerous natural harbors, together with the dense population which occupies its margins, have been influential factors in Setouchi's development as an important commercial sea. Not only is it followed throughout its entire length by the transpacific steamers but it is crossed from north to south by multitudes of small intercoastal and interisland boats engaged in an important domestic trade. This being a segment of the nation's well populated industrial belt, cities are relatively numerous although none of them are of first rank. Almost all of the larger cities have coastal locations and are maritime in aspect, each being an important trade center for a local hinterland and having frequent boat service with neighboring ports.

At the extreme eastern and western ends respectively of Setouchi are the important twin ports of Kobe-Osaka and Moji-Shimonoseki. Between these, and much more emphatically engaged in domestic trade, are nearly a score of lesser ports. Most of these are concentrated toward the central portion of Setouchi away from competition with the great "end ports", and in that portion where well-populated islands are most numerous. Some of the more important ones are located opposite constrictions in the sea or on important channels. All of them have significant connections with Kobe and Osaka through which they do most of their foreign trading, raw cotton for local textile industries being an important cargo item. Coal is the principal cargo received from the North Kyushu ports. Boats plying between the local ports only, tend in general to follow north-south routes connecting opposite cities on the Chugoku and Shikoku coasts. The water fronts of these minor ports are characteristically crowded with small craft of various sorts, so that from a distance one has the impression of a forest of masts. Sailing boats are often as numerous as engined craft.

Industry appears to be neither very specialized nor very concentrated although one is conscious of frequent isolated or small clusters of manufacturing plants in the cities and villages as he travels along the Setouchi coasts. Probably cotton spinning and weaving rank highest, but sake, beer, rubber, chemicals, tile, rayon, metal products, oil refineries, salt evaporators and numerous others are represented. Two of the most distinctive and local industries of Setouchi's coasts are the manufacture of salt (from sea-water) and the weaving of reed mats for "tatami,[93]" made from a cultivated aquatic plant, "I," grown almost exclusively in this region. Within the basin of Setouchi is 90 per cent of the country's salt-field area or a total of about 4,000 hectares (10,000 acres). Along parts of the coast these diked salt-fields with their geometric pattern of evaporating basins and drainage ditches, their salt piles and the small boiling plants adjacent, furnish a characteristic and distinctive landscape. Regional concentration of the country's salt-fields in Setouchi is primarily due to the prevailingly hot, bright, clear, summer weather with less rain, lower relative humidity and more sun-

[93] These are the universal floor covering in Japanese homes.

shine than other parts of Japan. Other favorable features are: (1) the moderate tidal range averaging about 3 meters which permits periodic filling and draining of the canals; (2) numerous small alluvial areas with clean sandy beaches and quiet shallow waters off-shore, and (3) the proximity of cheap Ube coal used as fuel in the boiling stations.

2a. THE ISLANDS.—The hundreds of islands which dot the surface of Setouchi are a characteristic feature of this Japanese Mediterranean. In order to observe the characteristic insular landscape features a crossing was made from Hiroshima (Chugoku) to Imabari, (Shikoku) in a small intercoastal steamer which called at numerous island settlements. In no instance did the 1,000-ton boat come alongside a dock at any of the island ports but was always met by a sculled lighter. Most of the islands are several hundred feet high, with steep forested slopes. Those composed of granite have somewhat softer contours with much bare whitish rock showing through the sparse vegetation cover. Slopes frequently end abruptly at the water's edge, so that low wave-cut cliffs or platforms are common features. Hidden away in little coves are small alluvial accumulations which are sites for small agricultural-fishing villages, although the tiny deltas are often so small that expansion on to the adjacent lower hill slopes and to reclaimed land along the sea margin has been necessary. Protection for the fishing boats belonging to the villagers is made by enclosing a trifling bit of sea behind a low stone breakwater. Many of the small islands adjacent to a larger mother-island have no settlements. Those exclusively used for rice cultivation are less likely to have permanent habitations than those where dry farms prevail, the latter requiring more constant attention. Since cheap grass fertilizer is so much in demand, on numerous islands grass is the exclusive crop. Because island farms are more often reached by boat than by road, the cultivated spots are distributed in a most irregular manner, location being largely determined by accessibility from the sea. Shrines, often dedicated to Benten, the sea goddess, who is the favorite deity, occupy conspicuous promontory sites and in prelighthouse days served as land marks for the navigators.[94] Of striking conspicuousness to a

[94] Hikoichiro Sasaki: The Cultural Landscape of Islands of the Inland Sea, (in Japanese), *Geog. Rev. of Japan*, 8 (1932), pp. 38-47.

foreigner is the cultivation of steep slopes made possible through artificial terracing. By this arduous means cultivation is often carried 400 to 600 feet up the steep hill sides. In such a slope environment unirrigated crops naturally predominate although rice is grown wherever possible. Groves of mandarin oranges are abundant on some of the islands.[95]

2b. SANYO DISTRICT (Southern Chugoku facing Setouchi). —Chugoku Peninsula (extreme southwestern part of Honshu), of which this Sanyo section comprises the southern two thirds, was formerly a complicated mountainous region composed of igneous and sedimentary rocks, which has been peneplaned and subsequently fractured into a series of blocks, some rising, others being depressed. The principal fault system trends N.E. by S.W. but this system is intersected at nearly right angles by another series of parallel faults. The uplifted oblong blocks or horsts are recognized in Japan under such names as Tamba and Kibi plateaus. Although in places remnants of the ancient peneplains still persist in the form of uneven upland surfaces, much the larger part of the area has been reduced to relatively rugged hill country with elevations scarcely ever exceeding 3,000 feet. Major drainage lines, determined by the fault net, show a striking lattice pattern, their entrenched, steep-sided and narrow valleys indicating rejuvenation. Where two fault lines with their respective valleys intersect, wide alluvial floored stretches result, this feature of the drainage lines being characteristic. Unlike Kinki, Chugoku is not a region of numerous alluvium-floored grabens. Resulting from frequent instances of stream capture, passes and saddles across stream divides are frequent.[96]

In this study roughly the crest of the divide in Chugoku is accepted as the line separating the northern or Sanin slopes from those of Sanyo. This boundary, geological and cultural as well as morphological, makes for an asymmetrical partition, since the highest land is much closer to the north than to the south coast. In general the sedimentary rock areas of Chugoku are somewhat lower in elevation, and dissection has been more complete, resulting in a finer textured topography than is true of the bolder, coarser, granitic areas. For purposes of discus-

[95] I. Watanuki: Villages in Setouchi, *Geog. Rev. of Japan*, 7, Dec. 1, 1931, pp. 59-70.

[96] K. Tanaka: Unpublished Manuscript on Setouchi, *op. cit.*

sion the interior hill lands of southern Chugoku are treated separately from the coastal margins.

2b[1]. *Interior Hill Lands of Southern Chugoku.*—The complicated landform features and occupance patterns, make broad generalizations resulting from reconnaissance observation not only difficult but also somewhat hazardous. Five rail lines cross Chukou from north to south connecting the trunk lines which parallel the Sanin and Sanyo coasts. As hill lands go, these of southern Chugoku, except the higher parts of coarse textured slopes, are well occupied, dispersed and semidispersed settlements prevailing. The settlement pattern is unusually complicated, coinciding as it does with the intricate system of drainage lines. Slope cultivation, with terraced hillsides planted in

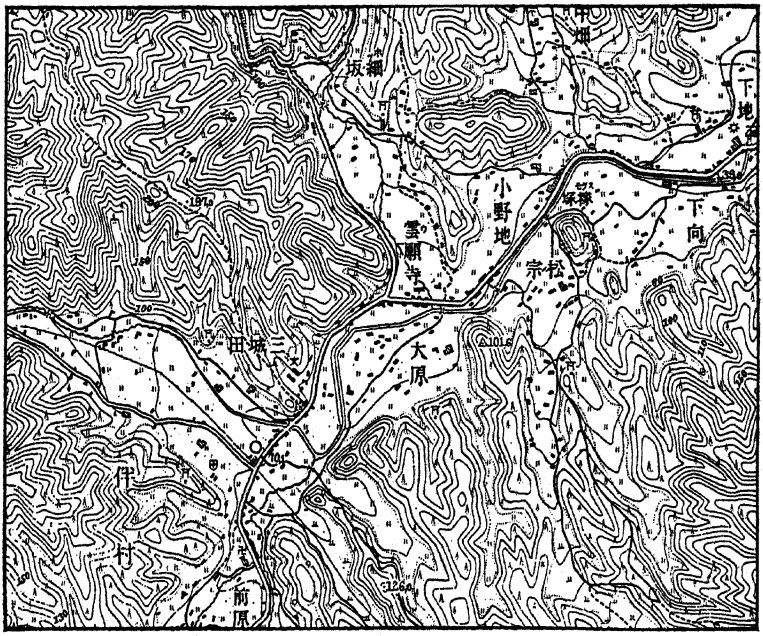


FIG. 44—Hilly interior Chugoku. Note the dispersed settlements. Scale 1:25,000.

mulberry, tea, tobacco, orange groves, summer vegetables and winter grains, is a characteristic feature. Rice occupies all irrigable sites. On the whole the region is not thoroughly specialized in any one crop, variety being a more distinctive feature.

Some fame is attached to the region by reason of it having the highest density of cattle population for any large part of the country, although even in the most specialized regions of cattle raising, there is on the average only one animal per farmer and the largest herds usually contain not over ten head. The animals are of native stock, usually black in color and are raised as draft animals and for beef purposes. Cattle markets are held regularly in many towns. During the three summer months, especially after rice planting, the animals forage for their food among the wild pastures and wooded slopes; during the remainder of the year they are kept at the farmstead.

(1) *Tamba "Plateau"* in eastern Chugoku, differs from the other sections in being largely composed of sedimentary rocks. Its high eastern margin with elevations of over 1,000 meters is the fault scarp overlooking Biwa, Kyoto, and Osaka depressions. The fault net is here less dense and the texture of slopes less fine than elsewhere in Chugoku so that settlement is less widespread and is more completely confined to stream valleys or to small waste-filled fault basins such as Kameoka, Tamba, Sasayama and Fukuchiyama. Wide interstream areas are largely devoid of settlement being left principally in woods or in wasteland.

(2) *Kibi "Plateau,"* in central Chugoku, is bounded on the north by a long and continuous much eroded fault scarp which separates it from the higher and more formidable hills or low mountains which are the principal divide of the peninsula. Kibi is a hilly land with elevations usually under 500 meters. The original peneplain surface is in an early stage of dissection, with steep sided valleys separating rather extensive areas of somewhat uneven upland surface, above which rise monadnocks. Fault features are not conspicuous. Most of the upland is in trees or cut-over wasteland, although its more flattish parts have been brought under cultivation. In low spots where water can be accumulated, rice is grown. Settlements in such regions are usually isolated farmsteads or loose clusters of the same, but genuinely compact villages are not so common. Even in many of the larger alluvial-floored valleys, settlements are lacking in compactness, the houses being located in irregular fashion along the margins of the valley or even on the bordering lower

hill slopes. Although Kibi is the heart of Chugoku's cattle country, on my trip across the region in July, 1932, not a single animal did I see grazing on the hill slopes, suggesting that the region's fame in cattle raising is only a very relative thing. Forest industries seem to be important, evidence for this being the piled bundles of wood and charcoal on the railroad station platforms.

Near the eastern and western extremities of this Kibi district are two relatively large areas of lower elevation, in general under 300 meters, where weak Tertiary rocks are prevalent. Typical Tertiary landscape features (wide, open, alluvial-floored valleys separated by hills of moderate to low elevation and a relatively dense dispersed rural population cultivating not only the valley floors but the hill slopes as well) are characteristic. Miyoshi and Tsuyama are the metropolises of the western and eastern basins respectively and lie strategically near the focus of radially converging valleys.

(3) *Western Chugoku*, with its dense fault net and highly developed morphological fault structure, consists of a series of narrow N.E.-S.W. horsts, highest in the north central part (over 1,300 meters), but descending step by step to the Sea of Japan and Setouchi coasts. Although fault valleys are numerous, there are no grabens. Rural population, commonly occupying isolated farmsteads, is relatively dense. Toward the extreme western end of Chugoku, where sedimentary rocks rather than granites prevail, elevations are relatively lower. In places typical karst features have developed.

2b^2. *The Coastal Margins of Southern Chugoku.*—The irregular southern coast of Setouchi, cala in type, has resulted from the sinking of a hilly land whose original features were the result of stream erosion and faulting. Along certain stretches islands are abundant but where nadas prevail these features are largely lacking. Many of what were former irregular arms of the sea or archipelagic channels, have been filled with detritus, forming a complicated and seemingly almost patternless system of alluvial valleys and basins, or in places small plains studded with hard-rock hills. Alluvial deposits here accumulate with surprising rapidity due to the rapid weathering of the rounded and often bare granitic hills. Reforestation of these

slopes, whose vegetation cover a relatively dense population has kept impoverished for centuries, is extremely difficult. None of the deltas are sufficiently large to warrant their consideration as separate units in this reconnaissance study. Hills frequently come down to the water's edge so that more often than not the

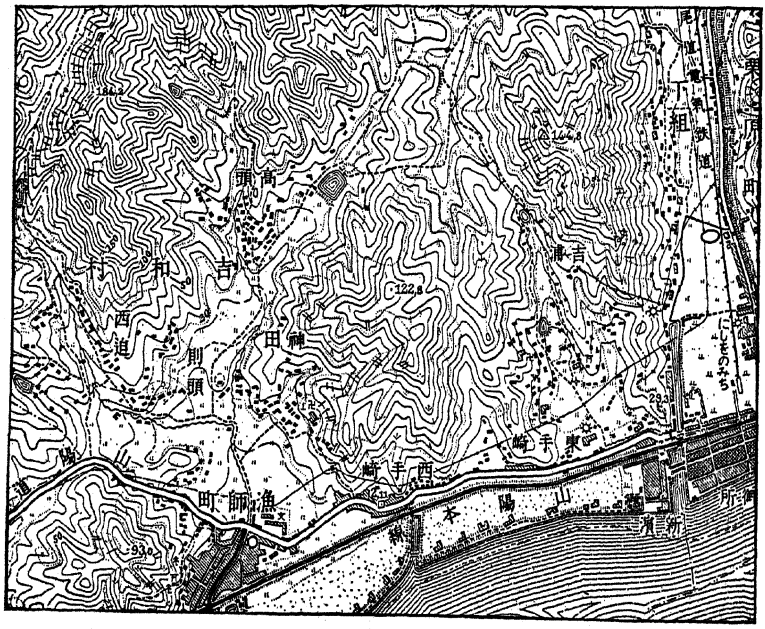


FIG. 45.—A section of the hilly borderlands of the Inland Sea along the Sanyo Coast. Dispersed and semi-dispersed settlement is very common. Slope cultivation is conspicuous. Note the salt fields along the coast. Scale 1:25,000. See plates 42 to 46 inclusive.

Sanyo trunk line railway, connecting Kobe and Shimonoseki, which parallels this coast, is interior variable distances from the shore and separated from it by hills. Diluvium on the whole is not areally conspicuous along the coast of Chugoku except toward the extreme east between Himeji and Kobe. There in the basin of the Tamba River is a relatively extensive area of old diluvium and Tertiary deposits which have been so thoroughly dissected as to nearly obliterate all smooth upland surfaces, but in which a labyrinthine pattern of alluvial-floored valleys has been developed. On the latter sites is a relatively dense dispersed population. Numerous artificial ponds in the adjacent hills provide water for irrigation.

Occupance is exceedingly complete although due to the fact that there are no extensive plains, large compact units of population are absent. Various forms of settlement are represented, dispersed and compact as well as intermediate amorphous types. The unusual thing is that in such a long settled region there should be so many isolated dwellings, prevailingly so in the hilly lands but common on the more open plains as well. On the extreme outer margins of some of the larger deltas where new land has recently been reclaimed for agricultural uses, the rectangular pattern of land subdivision and lines of communication, with isolated dwellings along the roads, remind one of Hokkaido. In no other part of rural Japan have I seen so many prosperous and attractive residences of relatively large size. Whitewashed, with red tile roofs, many of the houses look almost more Mediterranean than Japanese. These do not predominate to be sure, but they are sufficiently numerous to add brightness, color and charm to an otherwise attractive countryside.

Features of the agricultural landscape are in some respects distinctive. Artificially terraced hillsides are very conspicuous, and crops are similar to those of the islands previously described. Cattle population is relatively dense for Japan, many farmers raising beef and draft animals for sale, thereby increasing their meager cash incomes. This specialization of southern Chugoku in cattle seems to be in some way associated with army headquarters being located at Hiroshima during the Sino-Japanese war of 1894-95, and again in 1904 during the Russo-Japanese war, during which periods this region supplied large amounts of meat to the Japanese armies. A number of the coastal towns (Onomichi, Chiya, Niimi, Takahashi) are important cattle markets. The animals are kept at the farmsteads and fed on grass cut from the hill slopes and on crops grown on the tiny farms. Extremely high grade rice is produced on the relatively coarse alluvial soils, weathered from the adjacent granite hills. Winter cropping of the paddies as well as of the upland fields is very common so that this region has become one of the country's largest producers of naked barley and wheat, both fall-sown crops which are used for human as well as for animal food. Competing with rice for low, easily inundated sites along portions of the Inland Sea margins, is the reed crop, called "I,"

from which "tatami" mats are made. Practically the country's entire production is confined to two prefectures, Okayama and Kagawa, in southern Chugoku and northern Shikoku respectively. No doubt the clear, hot, summer weather, ideal for out-of-doors drying, is a major factor in this regional specialization, but local opinion attaches some weight to the supplies of white clay in the vicinity which are used as a bleaching agent. The plant is dark green in color, 3 to 4 feet tall and has a small cylindrical stem probably one eighth of an inch in diameter. Between Onomichi and Okayama it is particularly conspicuous, the dark green patches of "I" sometimes occurring singly or in small groups associated with rice fields, but not uncommonly there are several acres of continuous reed fields. In July, the harvest season, when I was in the area, the reed fields were alive with workers engaged in cutting the plant, tying it into bundles, dipping it in white-clay mud, or laying it out on the hillsides to dry. Many of the adjacent hill slopes were literally covered with the drying reed.

Shimonoseki (99,000) at the western extremity of Chugoku is on the Straits of Shimonoseki which is the main route for transpacific vessels to and from Asia by way of Japan. Only 1½ miles from Moji on the Kyushu side of the straits, Shimonoseki, which is the southern terminus of Honshu rail lines, has frequent ferry service with its Kyushu neighbor. It is really one unit of the North Kyushu heavy manufacturing zone, and although it contains a few representative industries of the region (cement, line, shipbuilding, brewing, fertilizer, railroad shops), its manufacturing hinterland is relatively limited. Of foreign trade it has practically none, Moji taking all of that, although its domestic trade is extraordinarily large.

Ube (61,000) is significant as a coal mining city. The adjacent coal field, having the same name as the city, is small (37.5 sq. km.), probable reserves and production are meager, and quality of product is inferior.[97] Most of the coal is taken from submarine collieries so that its transport by water is very inexpensive. Much of the output goes by small boats to the

[97] Reserves estimated at 76,500,000 metric tons and annual production in the neighborhood of 1,000,000 tons. Kyukichi Watanabe: Coal Resources of Japan, *Conference Proof of World Power Conference*, Sec. Meeting, Tokyo, 1929.

Osaka industrial region and to minor manufacturing centers in Setouchi Basin.

Hiroshima (270,000) is the metropolis of Central Setouchi. It was an important castle town during the feudal era and its modern growth was stimulated when it became military headquarters of the Emperor and his general staff, and principal base of operations, during the wars with China and Russia. It is still a military and political center, the fifth army brigade occupying the daimyo castle grounds. Although one of the principal local ports of Setouchi and served as well by the trunk line Sanyo Railway, Hiroshima is not primarily a commercial and industrial city. Its fame and charm seem to lie rather in a colorful historic background as well as in its present political and military functions. The city's hinterland is a much faulted granite hill country with relatively dense settlement. A local rail line runs north from Hiroshima as far as Miyoshi, tapping that important interior region. The site of the city is a small multiple-pronged delta at whose sea ends are several land-tied islands. Canals are abundant. Along the advancing delta fronts the waters are so shallow that it has been necessary to develop an outer port at Ujina on one of the land-tied islands, some 3 or 4 kilometers seaward from the heart of the city.

Kure (190,000) at the southern extremity of Hiroshima Bay is strictly a fortified military city, being the site of a naval station, steel works, arsenal and dock yards. It contains the greatest dry dock of the country.

Okayama (139,000), also a castle town, is today a local manufacturing center, and like Hiroshima, an important domestic-trade port. Having a delta site with shallow water off shore, it too has an outer port, *Uno*, some 15 to 20 kilometers to the south on a rocky coast, with which it is connected by rail. It is a railway junction point, the Sanyo trunkline here meeting one of the trans-Chugoku lines terminating at Matsue on the Sanin coast.

Omomichi (29,000), with its outer-port of Itosaki, is primarily a petroleum port so that its imports are predominantly of foreign origin.

2c. Inland Sea Margins of Shikoku.—Shikoku has two very unlike geographic subdivisions which are separated from each other by the great medial dislocation line of Japan, along which are developed rift valleys. To the north of this morphologic boundary is a fractured granite area, in most respects like southern Chugoku; to the south is a region of rugged folded mountains, a segment of the Outer Zone of Southwest Japan. The morphologic and geologic boundaries do not exactly coincide for a small and lower portion of the Outer Zone of Pacific Folded Mountains lies north of the Yoshino Graben and Matsuyama Plain which coincide with the line of dislocation. The landform set-up of northern Shikoku, with its two blunt granite peninsulas (Tanakawa and Sanuki) with broad Hiuchi Bay or Nada between them, is the result of differential fault-block movement, the two peninsulas being horsts and the bay a depressed block. It is noticeable that the granite peninsulas coincide in position with numerous islands in Setouchi, the latter marking tops of fractured sunken horsts. On the whole the coast line is not so irregular as that of Sanyo.

Many of the natural and cultural forms, their patterns and associations, already described for southern Chugoku, are repeated, with some modifications, in northern Shikoku. It is only contrasting items of landscape which are here stressed. The lowlands of North Skikoku, like those of Sanyo, are too small for individual analysis in this reconnaissance report. Significant contrast exists however between the two great peninsulas. The western one is compact, less fractured, contains very little alluvium and presents a relatively smooth coastline so that settlement is very meager except along the periphery. On the other hand Sanuki, the eastern peninsula, is like Sanyo in being much fractured and fragmented with considerable areas of alluvium occupying broad valleys and interisland depressions. As a consequence settlement is much more dense in the latter district. A distinctive feature of Sanuki's landforms is the conspicuous flat-topped and conical hills of andesite which stand out prominently in contrast with the more rounded and somewhat lower granitic hills. The conical hills, which are not numerous, may be remnants of volcanic plugs. The tabular hills, some of them rising 300 meters and more above the new alluvium which surrounds the archipelago of hard-rock "islands,"

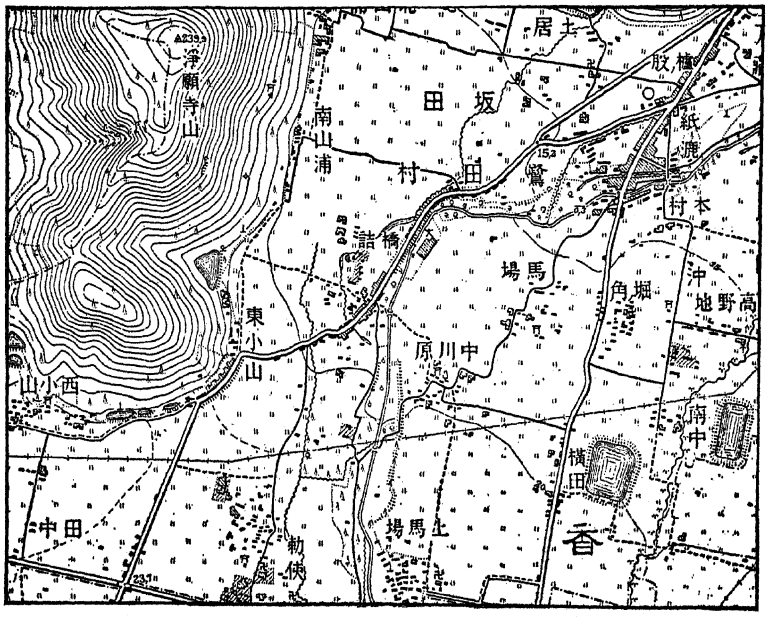


FIG. 46.—A section of Sanuki Peninsula in northeastern Shikoku in the vicinity of Takamatsu. A basalt-covered hill, with flattish top and steep margins, is conspicuous in the northwest corner. Dispersed and semi-dispersed settlement is relatively common on this plain where Handen imprint is evident. Scale 1:25,000.

have precipitous upper slopes where the andesite cap prevails, becoming conspicuously steep on the weaker granites which comprise the lower two thirds or more of their total elevation.

Low diluvial terraces with smooth or rolling surfaces are more prevalent, rivers are shorter and more variable in flow, and fan configuration of the detrital deposits is more conspicuous on the Shikoku coast than along Sanyo. In July when I saw the region most of the broad bowlder-strewn stream courses were either entirely dry or contained mere trickles of water. Supplementary irrigation, from what seem to be almost innumerable ponds, appears to be very common both on the alluvial delta-fans as well as on the terraces. The latter forms although less completely utilized than the more fertile new alluvium, are extensively planted to both rice and dry crops, reflecting long occupance of the region by a relatively dense population. Occupance patterns associated with the "Handen" system of land subdivision are very numerous on the plains of North Shikoku. It would be erroneous to give the impression that

evidences of this system are lacking in Sanyo, but certainly the imprint there is not only fainter but less widespread. Even in northern Shikoku it is not equally evident in all parts, and there are variations in forms. From the flat top of an andesite hill just north of Takamatsu one can look southward over one of the more extensive lowlands of the island, and behold a rural landscape where "Handen" features, expressed in terms of rectangular land subdivision, and road pattern, as well as in irrigation ponds, are very conspicuous. The compact village so well represented in Kinki, is here not so obvious, there being instead numerous isolated farmsteads, many of them located along the grid pattern of highways as they are in Hokkaido. A similar rectangular pattern of land subdivision and roads is conspicuous on the Matsuyama Plain but there compact villages are much more numerous, taking the place of isolated dwellings, while ponds are fewer. On the lowland adjacent to Imabari the mesh of the rectangular grid is considerably finer than in other sections.

Two small lowlands, 2c[1], *Yoshino Rift Valley* on the east and 2c[2], *Matsuyama Plain* on the west, are developed along the great median dislocation line in Shikoku, separating the Inner from the Outer Zone of Southwest Japan. In origin and landscapes they resemble the Kino Graben of Kii Peninsula. Yoshino, which is 80 kilometers long, is shaped like a very long thin spear. A conspicuous belt of river terraces and fans, well cultivated, and having a relatively dense dispersed type of settlement, borders the north side of the lowland. The valley floor contains much coarse sand and gravel, and evidences of river floods and lateral migrations are common. Mulberry, tobacco, indigo and other dry crops compete with rice in such an environment. Both of these fault valleys have local railroad lines, but they are not connected with any larger system. In fact, the whole railroad pattern of Shikoku is a series of fragments not organized into a system, the longest single stretch being the one that parallels the north coast.

No cities of large size have developed in northern Shikoku although five with populations between 25,000 and 100,000 are important local business and industrial centers, and in most cases ports as well, similar to those of Sanyo. Industries are

varied but with emphasis upon textiles, cotton weaving and silk reeling receiving most attention. *Tokushima* (91,000), at the seaward end of the Yoshino Graben, and serving that specific hinterland, is an ancient castle town. Its location some three kilometers inland, on a shallow river, has necessitated the development of a deeper outer port, Komatsushima, 7 kilometers to the south along the rocky coast. With its port Tokushima has both lighter and rail connections. *Matsuyama* (82,000) in a similar way serves the local hinterland of the western fault valley which has the same name as its principal city. It too has an outer port, Takahama, located not at the river mouth, but on an adjacent land-tied island. Two important local business centers, *Takamatsu* (80,000) and *Marugame* (29,000) serve the Sanuki hinterland with which is coincident the single greatest compact settlement group in Shikoku. Next to Hiroshima, Takamatsu has the largest water-borne trade of any of the local Setouchi ports. Here boats of up to 3,000 tons can come alongside docks so that an outer port is unnecessary. Marugame is not a shipping center, being served by the adjacent port of *Tadotsu*, which, next to Takamatsu, is Shikoku's leading port. *Imabari* (44,000) serving the narrow littoral plains flanking the western granite horst (Tanakawa) is, like Takamatsu and Tadotsu, strategically located at a narrows in Setouchi where islands are numerous. It has particular fame as a weaving center of cotton textiles. Along the open coast of deeply indented Hiuchi or Bingo Nada, where the precipitous fault scarp marking the northern boundary of the Pacific Folded Mountains comes close to the sea, there are no important cities.

Region 3. Sanin Littoral of Northern Chugoku

Literally translated the Japanese word Sanin means "shady side," and as applied to the northern littoral of Chugoku refers to the darker, gloomier, stormier weather there as compared with that of Setouchi. The contrasts between these two regions do not end with climate, for in its less indented coastline, more limited hinterland, lower population density, fewer cities, more meager development of manufacturing and commerce, entire lack of salt manufacture and citrus culture, Sanin presents a simpler landscape than that of Sanyo.

Since Chugoku is asymmetrical, in that the divide is closer to the north than to the south coast, the total area of land tributary to Sanin is neither large nor productive. Marginal downwarping, together with deep water off shore, has tended to produce an abrupt coast where wave-cut sea cliffs are conspicuous and large indentations rare. No in-sinking basins with relatively extensive alluvial accumulations such as exist along the Japan Sea coast of Ou and Chubu are to be found in Sanin. Where streams enter the sea tiny accumulations of alluvium develop behind outer belts of beach rides and dunes, but strong waves and currents prevent their seaward extension beyond the protection of the headlands. Alluvial plains are even smaller and less numerous than they are along the Inland Sea. Two exceptions to this rather featureless shoreline should be noted: (1) In mid-Sanin, the Shinji range, a horst 60 to 70 kilometers long, parallels the coast, attached to the mainland by a narrow isthmus of Tertiary rock and by river and wave sediments deposited in the intervening graben valley. (2) The extreme eastern part of the Sanin coast has suffered marked insinking, resulting in Wakasa Bay. Fault scarps mark both its eastern and western margins, while the deeply indented coast line of ria type reflects submergence of a hilly land with numerous fault-line valleys trending at almost right angles to the shore. Four separate volcanic groups occupy calderon-shaped depressions (einbruchkessel) along the Sanin Coast. The mightiest of these is Daisen (1773 m. elevation), just to the east of Matsue, a youthful cone with some tilled land on its smooth ash and lava apron. Hundreds of cattle and horses are pastured on its slopes. Hyonosen volcanic group (1510 m. elevation) south of Tottori is so thoroughly dissected that little if any of the original slope remains and a wild mountainous country is the result. Two smaller and less conspicuous groups of lava domes are found west of Matsue. Closely associated with volcanic activity are the fissure-type mineral deposits of Sanin, principally silver, copper and tin. Most of the mines are small but two of them, Ikuno and Akenobe in Hyogo prefecture in eastern Sanin, employ 979 and 500 workmen respectively.[98]

[98] Trends of Mining in Japan, 1930 (English Supplement) pp. 11-12.

Lacking extensive plains there are no large compact settlement clusters. Small agricultural-fishing villages are strategically located on little alluvial patches at the mouths of rivers whose valleys provide access to the rugged local hinterlands. Considering the nature of the country however, rural population is relatively dense, settlements being both compact and disseminated and occupying shallow upland basins as well as valley floors. There is not however the same abundance of open valleys with important concentrations of population extending back into the interior, as there is in Sanyo. Artificial terracing is common. General subsistence agriculture prevails, with some cash income derived from the sale of cocoons, wood products, tea and cattle, for this region is also a part of the Chugoku cattle area. Slopes have not been so denuded of their vegetation cover as they have in the Setouchi borderlands so that charcoal manufacture is an important auxiliary industry to farming.

There has been little reason for the development of large urban centers since both manufacturing and commerce are relatively unmodernized. Only three cities of over 20,000 population are to be found in Sanin, Matsue (45,000) and Tottori (37,000), prefectural capitals, and Yonago (34,000), a local manufactural center. Such industry as does exist—cotton weaving, silk reeling, porcelain, lacquer—is all housed in relatively small and inconspicuous plants and uses largely local raw materials. Railroad lines, constructed with difficulty because of the abrupt and hilly coast, parallel most of the Sanin littoral but are not continuous throughout its entire length. Ocean shipping is relatively undeveloped and ports are rare. During the winter, weather conditions and boisterous seas make navigation difficult, while the general lack of deep indentations has caused a dearth of natural harbors. In only two locations along the entire coast have even minor port cities developed, (1) in the deeply indented Wakasa Bay region at the extreme east and, (2) in mid-Sanin back of Shinji horst. In the former location there is only a very meager local hinterland, for alluvial lowlands are almost entirely absent and settlement is consequently meager. Two advantages partially counteract that handicap however: (1) the deep fiord-like indentations offer excellent protected harbor sites, and (2) a low and narrow range of hills,

some 15 km. wide, cut by tectonic depressions, is all that separates Wakasa Bay from the Biwa depression which is the natural lowland route to the great industrial and commercial settlements of Kinki and Ise Bay. Three or four small port cities occupy little alluvial patches at the heads of the deep bays, all of them of very minor importance except Shin-Maizuru, a fortified naval port (the only one along the Japan-Sea coast between Hakodate and Shimonoseki) and Tsuruga, a commercial port. The latter has direct rail connection with Biwa and draws likewise from the small Fukui plain just north of Wakasa Bay. Boats up to 6,000 tons are able to come alongside the dock. It is one of the few "open ports" on the west side of Japan, its chief trade being with Vladivostok (with which it has bi-weekly service), Chosen, and the east coast of Manchuria. Its principal imports are bean cake, soy beans, coal, wood and grain. Fishing is a specialized industry of the Wakasa Bay ports.

The other commercial port of Sanin, Sakai, is one unit of that single, largest, compact population cluster of North Chugoku, coincident with detrital accumulations back of Shinji Horst, and has been developed to serve in particular that local

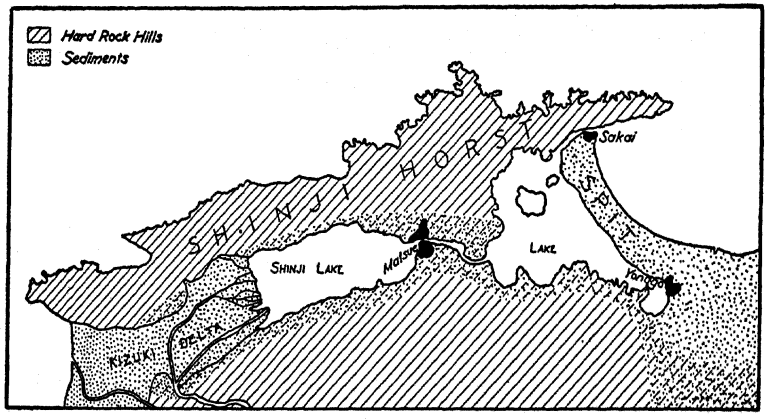


FIG. 47.—The Shinji Horst section of the Sanin Coast of Chugoku. See plate 48.

hinterland. Lying between the isthmus of Tertiary rock, which joins Shinji at its midpoint to the mainland, and the deposits

at the sea ends of the graben, are two shallow lakes. The western end of the graben is completely closed by a bay-mouth bar with beach ridges and dunes, back of which is the Kizuki delta-plain, the largest in Sanin. Dry crops, including mulberry and orchards, together with protective groves of conifers, occupy much of the elevated sandy seaward margins. The delta-plain is largely in rice but with much mulberry around settlements and along present and relict levees. The numerous silting distributary streams of the plain are dangerously elevated so that a new and artificial channel is being constructed, which is expected to carry the combined waters of all the channels. On the older western part of the delta, settlements are both agglomerated and dispersed, but toward the lower and newer eastern end, where settlement is more recent, isolated farmsteads of distinctive type are the rule. Each house is protected on its north and west sides from the winter winds by a high hedge of trees, 20 to 50 feet high, trimmed square on top. On the south and east sides of the farmstead there is no hedge. Seen from a distance each farmstead appears to be a small grove of trees. The houses are architecturally distinctive by reason of the thatched roofs with their saddle ridges.

The eastern end of the graben back of Shinji is likewise blocked, in this case by a combination spit and bar with conspicuous parallel beach ridges. Here a linear pattern of settlements, communications and agricultural features is very evident. At the extreme northern tip of the spit and protected from the violent winter winds by the Shinji hills is the local port of Sakai. Coal, wood, fertilizer and petroleum are its significant imports. From Sakai goods are taken by motor boat or by rail to Matsue, the prefectural capital and business center, and by lighter and rail to Yonago, a minor focus of industries, chiefly cotton textiles. Within the settlement cluster south of Shinji therefore, is a triumvirate of contrasting urban units, a port, a political center and an industrial city. Matsue, located on the Tertiary isthmus, is an ancient castle town remaining remarkably unaltered even to the present time, its narrow streets and alleys with numerous offsets having been planned with defense in mind.

Region 4. Northern Kyushu

Although out of harmony with Chugoku and Shikoku in terms of the directional trend of the long axis of the island itself, the strike of the principal morphological and geological features which compose it follows the general N.E.-S.W. direction exhibited in these other regions. Like Shikoku, Kyushu belongs to both the Inner and Outer Zones of Southwest Japan, a morphological fault scarp forming the steep northern face of the Kyushu Folded Mountains providing a distinct boundary between them. South of this fault scarp, landforms in general resemble the folded mountains of Kii Peninsula and southern Shikoku, although intersection with the Ryukyu Arc in southern Kyushu has resulted in modifications due to volcanic extrusions. North of the scarp, features resemble more closely those of Chugoku and northern Shikoku, granites being conspicuous, although here too volcanics have added many modifications.

An extremely complicated and varied morphological and geological structure makes simple division of northern Kyushu difficult and somewhat unsatisfactory. Three general divisions, each containing a considerable degree of variability, are here recognized: (1) The Tsukushi Hills and similar smaller but isolated areas in northwestern Kyushu are essentially a fragment of Chugoku. Granitic rocks are most prominent, although sedimentaries are not lacking. Fault-block structure prevails. (2) South of Tsukushi and between it and the Kyushu Folded Mountains is a dissected lava and ash plateau with numerous large cones. This volcanic region occupies in Kyushu a comparable position to the Inland Sea basin between Chugoku and Shikoku. (3) Hizen Peninsula and the Amakusa Islands comprise the very irregular and loosely articulated region of western Kyushu. Geologically and morphologically subdivision (3) is somewhat transitional in character between (1) and (2), for both recent volcanic and Tertiary rocks are prominent.

Climatically this northern Kyushu region is intermediate in character between Sanin and Sanyo, having totally more rainfall and less sunshine, particularly in winter, than the latter, but more sunshine than the former. It is less well pro-

tected than Sanyo from the northwest monsoon, and the damp chilly winters with considerable cloud are disagreeable. Summer heat is more humid and oppressive.

With the exception of the volcanic region, this subdivision is a part of Japan's ancient, and still most important, culture zone which includes Kinki, the borderlands of Setouchi, and northern Kyushu. Population is dense, cities are numerous, and manufacturing relatively well developed, this being the fourth principal node in the country's industrial belt.

4a. Tsukushi Hill Lands and Associated Plains.—Composed largely of uplifted and dissected tilted blocks with tectonically depressed intervening lowlands, the district gives the impression of being a hill country but without much order or system in the arrangement of the various units. Some of the tectonic basins were in past geological ages, particularly the Tertiary epoch, estuaries, which became partially filled with coal bearing sediments. Since uplift these weak Tertiary strata have been thoroughly dissected, forming low hilly tracts with wide open valleys, in the midst of more formidable granitic hills. What were formerly very irregular coasts with numerous islands, both along the Japan Sea and Setouchi, have been considerably smoothed by alluvium deposited behind crescentic beach ridges and bars. Numerous islands have been thereby tied to the mainland. The coastline is still far from smooth however although good natural harbors are relatively rare.

Two large and unlike hill masses, separated by a tectonic valley comprise most of Tsukushi proper. The western half, designated as 4a[1]—*Seburn Horst,* is a compact and relatively rugged block possessing typical granitic features. Occupance is relatively meager, although some cultivation is carried on both in the narrow and intricate valleys and in those typical shallow upland basins whose moderate slopes contain numerous terraced paddies.

4a[2]. *Chikuho Block "Mountains."*—East of the dividing fault valley compactness of form is lacking, Chikuho consisting of detached clusters of hills, mostly fault blocks, with intervening fault basins. Sedimentary rocks are more common, and oc-

cupance is much more complete than in Seburu. Extending from north to south through almost the middle of this area is a basin 40 to 50 kilometers long and 10-12 kilometers wide

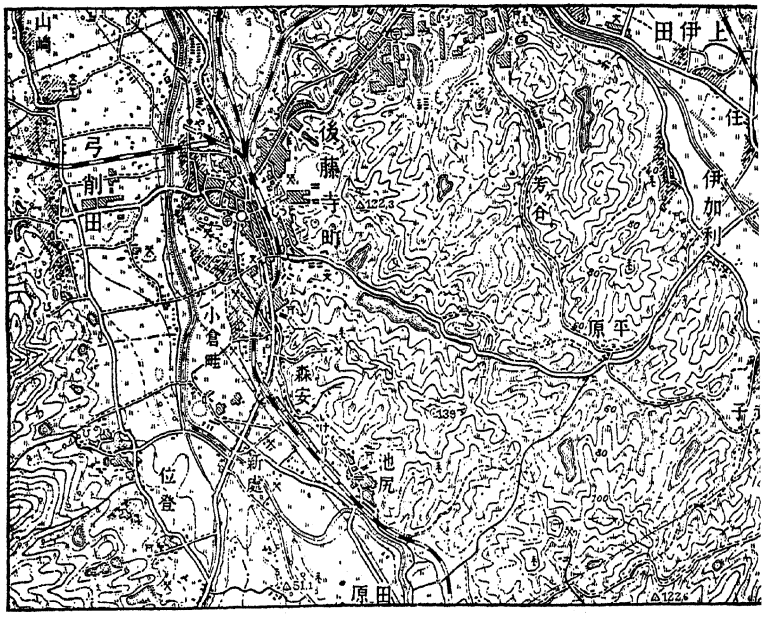


FIG. 48.—A section of the Chikuho coal basin in northern Kyushu. Except for the coal fields this is a representative landscape in a region of weak Tertiary rocks. Hill country of moderate relief and slope predominates. The intricate valley system is coincident with paddy lands. Slope cultivation is common and irrigation ponds are numerous. Scale 1:50,000.

drained by the Onga River and its tributaries. Low rounded Tertiary hill masses, separated by alluvial floored valleys of variable widths, characterize the basin. Water from numerous ponds located among the hills supplements the supply from normal rainfall and rivers necessary to irrigate the paddies which tend to monopolize the alluvium. On the hills, woods and waste land prevail, although the lower slopes not infrequently have terraced fields.

The particular fame of this basin however, is that it contains the most important coal field, Chikuho, in Japan, producing annually about 15,000,000 metric tons of coal or approximately one half of the nation's output. In quality most of it is subbituminous, only small amounts being satisfactory for even an inferior grade of coke. Complicated faulting and tilting of the coal-bearing strata have greatly increased the difficulties and

costs of mining operations. In the neighborhood of 40 mines of respectable size are in active operation, while scores of smaller ones are worked in a somewhat desultory fashion. The larger plants are usually shaft mines, only the smaller ones working outcrops. Characteristic features of mining areas—conspicuous top works with extensive workmen's barracks, mine dumps, long lines of coal cars in transit or on sidings—are all to be seen, yet the mines are sufficiently scattered as well as hidden among the hills, so that the landscape remains distinctly more agricultural than saxicultural. There has been in recent years a gradual shifting of mining operations up the valley as the older mines in the lower valley are being worked out and abandoned. Within the basin a complicated railroad system, dendritic in pattern, connects the coal field and its individual mines with the north coast where the product is both consumed locally in large quantities by the heavy industries of that region, as well as exported to other parts of Japan through the ports of Moji and Wakamatsu. Coal from Chikuho dominates in the markets of Japan about as far north as Nagoya; beyond that latitude coal from the Joban and Hokkaido fields displaces it. There are no manufacturing developments within the field itself but rather at tide-water only a few miles distant to which location necessary raw materials can be brought by boat without transhipment.

4a[3]. *The Coastal Margins.*—Along the indented, island-studded littoral of Tsukushi with its numerous small and very irregular fragments of alluvium, agricultural uitlization is intensive but there is little about it that is unusual. Double cropping of the paddies is common, which causes the planting of rice to be relatively late, often not until mid-July. Not only the alluvial plains, but the lower slopes of adjacent hills as well are cultivated, although not nearly to the same degree as in Setouchi. Villages tend to concentrate along the drier inner margins of the lowlands adjacent to the hills or along the beach ridges, in the latter location commonly protected by a wall of conifers on their seasides, and surrounded by fields of unirrigated crops. At the north end of the tectonic depression which separates Tsukushi into two parts (Seburu and Chikuho) is the relatively large Fukuoka Plain. In its Tertiary border-

lands, particularly to the east of the city, is the small Kasuya coal field, with not more than half a dozen mines each producing over 50,000 tons of coal annually. Fukuoka City (228,000) comprises at present what were formerly two unlike urban units, (1) Fukuoka Proper, an old castle-town of great fame and a modern political and university center, and (2) Hakata, a somewhat less elegant but ancient port city, containing a number of manufacturing plants. Very definitely this urban unit serves not only the Fukuoka Plain hinterland, but also, by way of the north-south fault valley, the Saga Plain, the largest in all Kyushu, lying south of Seburu Horst. Fukuoka's spit harbor is relatively well protected, but shallow (2½-5 m.), so that only shallow-draft boats can enter. Most of its sea trade is domestic although a few boats engaged in foreign trade call, delivering cargoes of petroleum, lumber (for the coal mines), and fertilizer, more especially the first item since Fukuoka is the site of the Rising Sun Oil Company's agency. Most of the overseas trade is with the United States. The principal out-going cargo is coal derived from the adjacent local coal field. Even the Hakata section of the city does not have a distinctively industrial aspect, for most of its manufacturing establishments are relatively small and do not require bulky raw materials. A renown of long standing has been attached to Hakata's silk and cotton fabrics of special quality and form, such as brocades for the "obi" or kimono sashes.

The Industrial Belt.—While much of northern Kyushu is coincident with the southern end of Nippon's manufacturing belt, over much of the area industries are scattered and isolated as they are in the Inland Sea Basin, or along the Tokai coast between Tokyo and Nagoya. In one region in particular however, there is a very definite localization, namely the narrow coastal strip, 25 to 30 kilometers long from Moji on the Straits of Shimonoseki at the east, to Orio or Yawata on the west, and between these terminal cities including Kokura, Tobata and Wakamatsu. Special fame and distinction belongs to this industrial strip for it contains the nation's greatest concentration of heavy industries with particular emphasis upon the refining of metals, especially iron. At least one half of all the factory workers are employed in the heavy metallic industries as com-

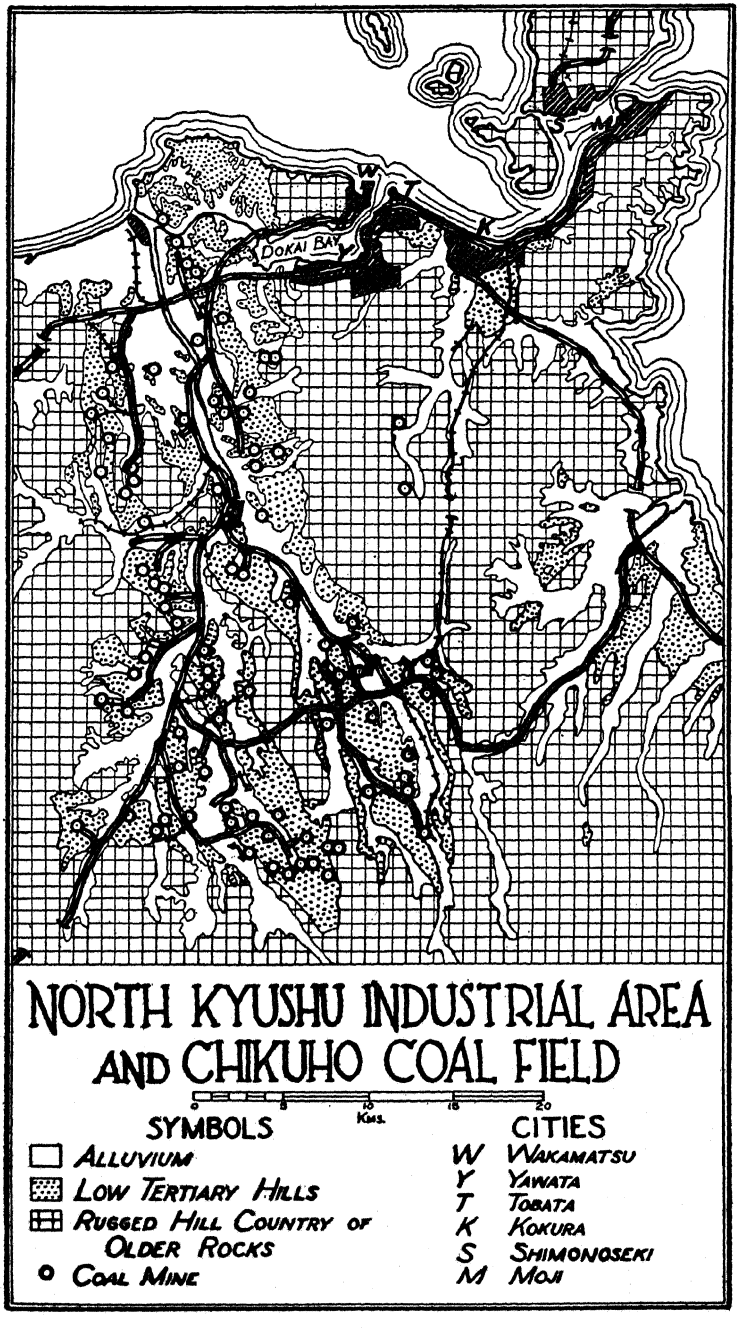


FIG. 49.—Industrial cities have not developed in the coal field but rather at tidewater along the northeast coast of Kyushu where imported raw materials meet Chikuho coal.

pared with 19.1 per cent for the country as a whole.[99] The combination of factors which has made this location particularly desirable for manufacturing development is: (1) the proximity and easy access to Chikuho coal, and (2) available water transport for imported bulky raw materials (iron ore, pig iron, wheat, petroleum, raw cotton, bean cake, fertilizer) and similar heavy and bulky exports of coal and manufactured wares. Not only has it an advantageous tidewater location, but more particularly it is on the Straits of Shimonoseki which is the necessary converging point for traffic between the Asiatic mainland on the one hand, and Japanese ports, North America and Europe to the east. Rail traffic between Honshu and Kyushu also converges on the Straits where ferry service is provided, so that Shimonoseki is a crossroads of rail and water routes. Proximity to China, Manchuria and Korea, the principal foreign trade regions for this industrial area, is likewise advantageous. Its handicaps are associated with, (1) the lack of protected and deepwater harbors, (2) the meagerness of level land for factory sites, and (3) its peripheral location with respect to the principal domestic consuming markets. Most of the boats engaged in the Asiatic trade are, however, of shallow draft so that shoal roadstead harbors are not so much of a handicap as at first might appear to be the case. The market for its finished products is almost entirely within the country where again the services of only small boats are required. It seems likely that the advantages possessed by North Kyushu in its accessibility to fuel and to water transport will continue to cause it to grow as the principal center for heavy manufactures, probably at the expense of certain other less strategically located centers.

Throughout the narrow industrial belt, never more than a mile wide and with hills almost reaching the water's edge in places, urban forms are nearly continuous. Since industrial and commercial functions demand the level waterfront locations, residences are often forced to occupy adjacent hillslope sites. With one exception (Kokura) all these industrial cities are of relatively recent origin, owing their exceptional growth to modern manufacturing, and in a less degree to ocean trade. Lacking any connection with premodern Japan, they have no Or-

[99] Orchard: Japan's Economic Position, *op. cit.*, p. 169.

iental charm and are completely wanting in attractiveness; on the contrary they are dirty, grimy, smoke stained and wholly unbeautiful. In many Japanese industrial areas, where workshops rather than factories are the rule, the ugly features common to manufacturing districts can be partially hidden or camouflaged. This is impossible in North Kyushu where the very size and nature of the industries—blast furnaces, steel mills, machine shops, cement factories,. flour mills, sugar refineries, and others—precludes any softening of their starkness. The region looks industrial with its huge dirty buildings, unsightly chimneys belching black smoke, piles of coal and iron ore, huge waste dumps, scores of railroad tracks, and covering it all a murky sky. The retail commercial sections of the cities occupy inner portions of the costal strip with manufacturing plants, docks, piers and warehouses along the sea margins. The larger plants are often at the waters edge where cargo boats or lighters can unload directly on to their docks. Some have specially arranged slips so that freight cars ferried across from Shimonoseki can be brought alongside their warehouses. Those plants, which from lack of room are forced to locate a few hundred feet back from the waterfront, have boat service by means of canals or canalized rivers. Convergence and crossing of rail and boat routes at Shimonoseki Straits cause this region to be conspicuously specialized in transport forms as well as in industrial features. Numerous craft of almost every description dot the Straits, many in transit, others anchored at buoys and loading and discharging cargo by lighters. Scores of fishing boats and lighters, jammed closely together, occupy protected anchorage basins behind breakwaters. Moji, Wakamatsu and Yawata are all freight ports of some consequence, the first two ranking fifth and sixth in foreign trade for the nation.

Moji (108,000) on the south side of the Straits of Shimonoseki (less than 2,000 m. wide), and backed by relatively high fortified hills, is a veritable Gibraltar. It has had its principal development since 1887 when it was made the northern terminus of the Kyushu railroads and the Kyushu ferry terminus as well. Ferry boats leave at 15 minute intervals. The city's site has determined its dimensions, for while it parallels the coast for 3 to 4 km., its width averages only 500 to 1,000 m.

Moji Port serves not only its own industries but those of the whole manufacturing belt of which it is a part, for some of the industrial cities such as Tobata and Kokura are not "open ports" and consequently are served by lighters, principally through Moji. Along that part of the city's waterfront farthest west, coal wharves dominate the scene but nearer the heart of the city are the general freight docks alongside of which boats of 3,000 to 13,000 tons can anchor.[100] Of the large trans-Pacific liner's only the N. Y. K. boats stop at Moji, these being serviced by lighters. In normal years imports are nearly double

FOREIGN TRADE OF MOJI, 1931, IN YEN

Exports		Imports	
Portland cement	7,783,000	Ginned cotton	9,863,000
Printing paper	4,386,000	Petroleum and petroleum products	3,430,000
Rice	4,334,000	Sugar	2,994,000
Refined sugar	3,897,000	Machines and instruments	2,719,000
Boots and shoes	2,854,000	Bean cake and other oil cake	2,685,000
Metals and metal products	1,616,000	Wheat	2,437,000
		Iron ore and pig iron	2,312,000
Total (including "all others")	39,512,000	Other metals (crude and semi-processed)	2,051,000
		Chemicals	1,718,000
		Rubber	1,327,000
		Meat	1,160,000
		Total (including "all others")	43,031,000

exports (1928: imports 80,900,000 yen; exports 43,700,000 yen) the former being largely raw materials for the industrial hinterland, while the latter are to a very large extent manufactured goods destined for Oriental markets, principally China. Imports are more varied in origin, with the Far East leading as the principal source although the United States is the most important single country. As a coal shipping port it is second only to Wakamatsu, most of this product remaining within the country, and consequently carried by lighters and other small craft. Moji's location on the main traffic thoroughfare, and its moderately deep-water harbor, make it an important bunkering station. Similarly it has high rank as a fishing port.

Concentrated in the western one fourth of the city, Moji's industrial section is very definitely in the vicinity of the great

[100] Mecking: Japan's Häfen, *op. cit.*, p. 314-317.

coal docks. A considerable variety of manufacturing plants occupy characteristic water-front locations, there being a steel plant, sugar refinery, brewery, bottle factory, flour mill, alcohol distillery, rice mill, machine shops and a copper-wire establishment.

Kokura (88,000), next to the west, is an old castle town which has been largely metamorphosed. In earlier days it was the northern terminus of the great Kyushu highway and at that time it was from Kokura rather than from Moji that one crossed to Shimonoseki. The coastal strip is here somewhat wider so that the city is less linear in dimensions than Moji and is bordered on its land side by low paddy fields instead of terraced hill sides. Its harbor facilities are undeveloped so that it must be served by lighters, principally from Moji. Its industrial belt is continuous with that of Moji's the principal industrial plants along the waterfront being two steel mills, two chemical factories, and a gas and electric plant. Located on the landward side of the city, but served by canals, are a rice mill and plants manufacturing porcelain and lime.

Beyond Kokura there is a break of perhaps 2 kilometers in the urban belt until Dokai Bay and its industrial littoral are reached. This nearly land-locked, well-protected body of water (6 km. east-west by 2 km. north-south) with only a narrow entrance (300-800 m. wide) at its eastern end, is probably a sunken river valley, shallow and handicapped by rapid silting. Constant dredging is necessary to keep it open for even the small ocean freighters (up to 3,000 tons) which serve the industries along its shores. The western one third is not dredged and is consequently too shallow for navigation, with extensive mud flats exposed at low tide. In this part the shores are not urbanized and the few industrial plants located there are served by rail exclusively. From a vantage point on the hills back of Wakamatsu on the north side of Dokai Bay one is able to get a complete panoramic bird's-eye view of the region although the smoky air tends to obscure details and photographing is forbidden, this being a fortified zone. The landscape items which stand out most distinctly are: the large factories with their conspicuous smokestacks, chief among them the great iron and steel plant at Yawata; the extensive coal docks and the huge

piles of coal along portions of the waterfront; the numerous small freighters, some anchored at buoys, others alongside the docks; the hundreds of lighters and small sailing vessels lying behind low breakwaters; scores of railway tracks with long lines of moving or stationary coal cars. Three important industrial cities occupy portions of the Dokai littoral, *Wakamatsu* (57,000) on the north side of the narrow entrance, with *Tobata* (52,000) just opposite, while *Yawata* (168,000), continuous with Tobata, extends farther south and west along the south side of the bay. Occupying a large part of the Tobata waterfront is the government-operated Oriental Iron Smelting Plant, and the great coal docks, modernly equipped with electric cranes. In addition there are coke ovens, bottle, brick, cotton thread, and plate glass factories, together with a sugar refinery. Wakamatsu across the channel occupies not only a narrow coastal strip and considerable reclaimed land, but the adjacent hill slopes as well. Most of the factories—an oil refinery, steel mill, machine and tool shop, and a small ship building and repair yard—occupy reclaimed land near the channel entrance. Wakamatsu Port, which includes both sides of the channel, obtains special fame as Japan's greatest coal exporting center, all of the product coming from the adjacent Chikuho field by rail. Loading is done from piers on both the Wakamatsu and the Tobata sides. Most of the exported product is carried to the numerous ports of southwest Japan in small coastwise sailing vessels. Some larger boats anchor at buoys and are serviced by lighters although many small steamers load at the docks, chiefly on the Tobata side.[101]

Yawata, (168,000) the largest and most important industrial city of Chikuho, is also the principal focus of iron and steel manufacturing in Japan, being the site of the government-owned Imperial Iron and Steel works, whose plant covers 1,650 acres and employs 20,000 workers. In 1926 the Yawata Plant plus its subsidiary at Tobata produced 79 per cent of the total output of pig iron in Japan Proper and 58 per cent of the steel.[102] The plant is located along the waterfront and has its own docks at which are received, from foreign sources, its total

[101] Mecking: Japan's Häfen, *op. cit.*, p. 295.
[102] Trade Information Bull. No. 612.

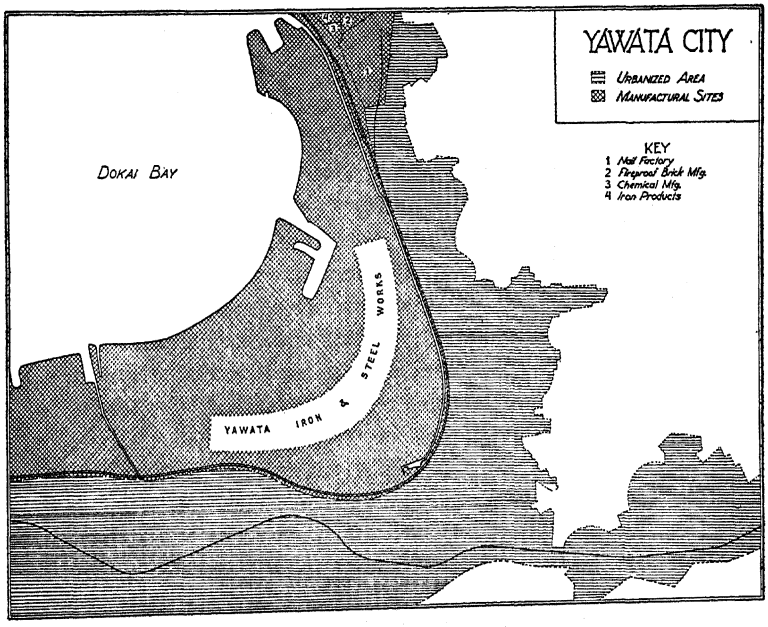


FIG. 50

requirements of iron ore and some coking coal as well.[103] Unfortunately the steel mills rather than the blast furnaces occupy the shoreside of the plant so that the ore must be carried by aerial cables over the steel mills and rolling mills to the blast furnaces. Four hundred and seventy by-products coke ovens are associated with the Yawata plant, most of the coal, including that for coking purposes, coming from the adjacent Chikuho field. About 10 per cent of the supply arrives from the Kaiping field in North China, this imported product being mixed with the domestic coal to make a satisfactory coke. The rolling mills at Yawata, which produce all forms of steel except pipe, are the principal source of raw materials for machine, tool, and hardware manufacturing plants scattered throughout the country. The numerous iron-products fabricating plants within the North Kyushu industrial zone reflect the advantage of proximity to necessary bulky raw materials produced at

[103] Statistics for imports and exports at Yawata are not available. Ore comes principally from Malaya, China, Korea, and Australia. Some pig iron is likewise imported.

Yawata.[104] Westward from the Imperial Steel works, along the shores of Dokai Bay manufacturing plants are not numerous, this being near the western limit of the local industrial zone.

4a[4]. *Tsukushi Plain.*—This largest alluvial lowland in Kyushu, lying just south of the main Tsukushi Range and drained by the Chikugo River, has conspicious features of "Handen" influence,—rectangular pattern of roads and canals, together with numerous small compact settlements. Extensive vistas are rare. On the low newly-reclaimed land along the sea margins however, where rice is the exclusive crop, villages are largely lacking. The fragment of dissected low diluvial terrace in the vicinity of Kurume appears to have considerable areas planted in groves of "hazi" trees, from whose berries is obtained a wax used in the manufacture of glossy paper. The tree being distinctly subtropical in its habitat requirements, is confined to the milder parts of Japan, over one half of the total crop acreage being in Saga and Fukuoka prefectures of northern Kyushu. Both Kurume (83,000) and Saga (46,000), the latter an old castle town, have industries of some consequence, emphasis being upon cotton textiles. In the smaller towns and cities of the plain as well, factories are not lacking.

4a[5]. *Miiki District.*—To the south of the Tsukushi Plain in the vicinity of Omuta is a small area which in its geognostic and landform characteristics appears to be a detached fragment of the Tsukushi Range, although lower in elevation. In the tilted Tertiary rocks (shale, sandstone and conglomerate) which flank the granites on their sea side, are important coal measures, the mining area being designated as the Miiki Coal Field.[105] It is small in area, about 10 square miles, but ranks fourth in production (after Chikuho, Ishikari, Joban), the annual output being between 2,000,000 and 3,000,000 tons. Half a dozen large mines with conspicuous top works and dump heaps are to be seen in the vicinity of Omuta, but only three mines were operating in July 1932 when I visited the area, the others

[104] The equipment of Yawata consists of 6 blast furnaces (annual capacity 465,800 tons), 31 open hearth, 7 crucible and 3 electric steel furnaces (987,000 tons annual capacity), and over a dozen rolling mills. Trade Inf. Bull., No. 612, *op. cit.*

[105] The Miike Coal Field: Guide-Book, Excursion E-3, Pan-Pacific Science Congress, Japan 1926.

having been worked out. One of the three large mines, (Yotsuyama) located right at the water's edge, is working submarine seams. The Miiki coal is sub-bituminous in quality but is nevertheless some of the best produced in Japan. An outer belt line of railroad around Omuta collects the coal at the Manda and Miyanomura pits and takes it to the harbor and port for Miiki a mile or so to the south of Omuta. At that point the Mitsui interests which own the mines have constructed an entirely artificial harbor especially equipped with modern machinery for coal export, at which 10,000-ton boats can be loaded by derricks in the outer harbor, and 5,000-ton vessels can load at the piers in the inner harbor. Miiki is emphatically a coaling port, this one item comprising 90 per cent of the value of its foreign exports. Its imports, much smaller in value, are in part, raw materials for Omuta industries.

Directly associated with the available supply of coal for power, is the concentration of industries within the city of Omuta (97,000) which lies within the Miiki coal field. In its dirty, smoky appearance and its conspicuous factories it reminds one of the north-coast industrial cities, except that it is not a port and must therefore depend upon adjacent Miiki harbor. All of the factories are owned and operated by the Mitsui interests who control the mining properties. Seven relatively large industrial plants—coke ovens, using some Chinese and some Chikuho coal, a dye factory making use of by-products from the coke ovens, machine shops, zinc refinery, nitrate fertilizer plant, a fireproof brick establishment and a cotton spinning factory—are all concentrated in the same vicinity on the northern margin of the city where cheap land is more available. They do not occupy tidewater or canal sites.

4b. The Northern Volcanic Region.—Between the Tsukushi Hills to the north and the Kyushu Folded Mountains to the south, and rising out of and completely burying the western end of Setouchi depression, is an extensive area of ash and lava deposits. So diverse and complicated are the forms that any brief description is inadequate. 4b[1]. In gross anatomy the northern portion is composed of several relatively high strato, shield and lava-dome volcanoes, with associated andesite plateaus which are believed to be the product of fissure eruptions.

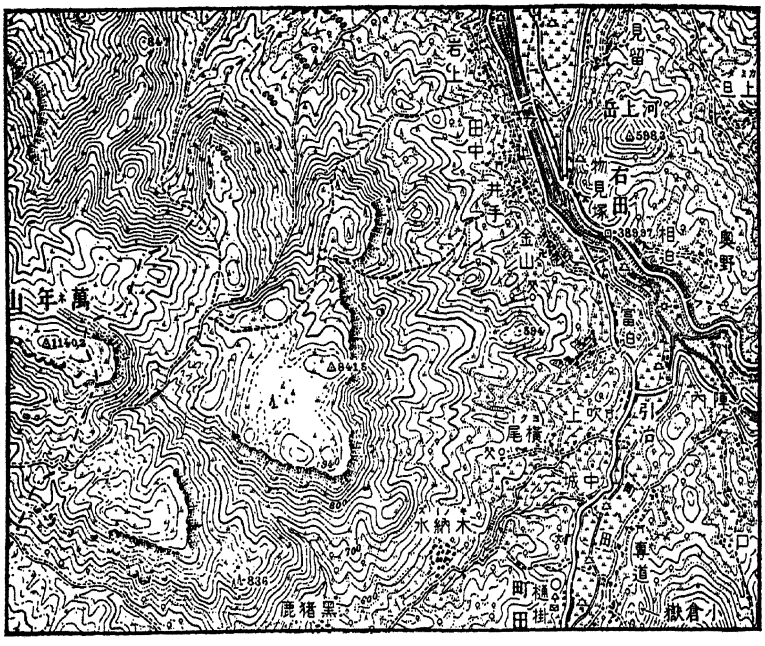


FIG. 51.—A section of the dissected lava plateau of North Kyushu. Flattish tablelands with precipitous margins are conspicuous. Settlement is principally confined to the intricate valleys. Scale 1:50,000.

The Lava Plateaus have been altered by faulting and erosion so that they present a confusion of fantastic features. Mesa and butte forms with steep bordering cliffs are common. Where dissection has opened up valleys or basins there is considerable occupance, isolated farmsteads and loose agglomerations being the rule. In places artificial terracing for rice as well as dry crops is remarkably developed. Circular Kunisaki Peninsula projecting into the Inland Sea is composed of a maturely dissected conical volcano with perfect radial drainage and an equally perfect radial culture pattern coincident with the drainage lines. Slight submergence along the northeastern side of Kunisaki has drowned the lower ends of the radial valleys but for the most part the coast of the volcanic region is bordered by low diluvial terraces whose smooth but sloping surfaces are planted in deciduous orchards, mulberry and the usual dry crops. Beppu City (43,000) on the east coast just to the south of Kunisaki Volcano is a famous hot-springs resort center.[106]

[106] Beppu, The Hot-Spring City: Guide-Book, Excursion—1, 5, Pan-Pacific Science Congress, Japan 1926.

There are 1,300 hot spring vents within the city of which 800 are used for bathing purposes. Numerous hotels and inns cater to resorters and convalescents who are attracted to the spot by reason of its mild winter weather as well as the spas. The city is located at the base of a steep symmetrical fan composed chiefly of coarse volcanic detritus. Terraced paddies which occupy the lower part of the fan have their retaining walls made of black andesite boulders taken from the volcanic sediments. Beppu, as well as Oita (57,000), an old castle town slightly farther down the coast, are ports of call for coasting steamers.

4b[2]. The southern and south-western part of this Northern Volcanic region is largely composed of the mighty cone of active *Mt. Aso*[107] and its associated lava, mud, and ash uplands, extending across almost the entire width of Kyushu and covering an area of nearly 2,000 square km. Most of the lava is hidden under subaerially deposited ash but is nevertheless exposed along the sides of valleys. Aso's crater, which measures 16 kilometers east-west by 24 kilometers north-south is one of the world's greatest calderas. From the crater floor rise five new volcanic cones some of them active and one reaching an altitude of nearly 1,600 meters. Two crescentic basins, a north and a south, occupy positions between the crater walls and the central cones, both atrios having at one time held lakes in which volcanic and water-borne sediments were deposited. These elevated lacustrine plains within Aso's crater are now well occupied by a dense rural population, growing rice upon the lower wetter portions and dry crops at the higher levels. Winds are strong at these elevations and as a consequence the villages are tree enclosed. The intercoastal railroad line passes through the crater by way of the north atrio, the ascent on the west along the gorge-like valley which drains the crater, being difficult and spectacular.

The outer slopes of the somma are relatively mild in gradient, nowhere more than 10°, while to the east they are often only 2°-3°. Radial drainage is conspicuous. The original ash-mantled lava and mud surface was at first, no doubt, smoothly rolling, but rivers have incised relatively steep walled valleys, between which are wide remnants of the slightly roughened up-

[107] Aso Volcano: Guide-Book, Excursion 4, Pan-Pacific Science Congress, Japan, 1926.

land. Local relief is usually not over 300 to 400 feet. The higher portions of the ash uplands, close to the crater where showers of ash are frequent, are covered with coarse wild grasses upon which horses and cattle are grazed. At lower elevations, more accessible and less subject to current showers of ash, cultivated lands become somewhat more abundant, although there are some evidences that occupance has been recent. On the valley floors is an intricate dendritic pattern of rice lands while the ash uplands are devoted to dry crops. Dispersed settlement is common.

The Shiro River, which flows westward from Aso draining the two atrio basins, has deposited along the western foot of the volcano a large diluvial fan. At its crest where it contacts with Aso lava, 25 kilometers from the coast, its elevation is approximately 200 meters. Much of the fan's surface is relatively smooth although streams have incised shallow gorge-like valleys and have developed a number of terrace levels, often separated by steep declivities. Dry crops predominate on the upland surfaces, mulberry being especially important. Considerable areas are left in woodland. Kumamoto (164,000), capital of the prefecture, near the sea margin of the fan, is not an industrial city of consequence. Besides being a prefectural capital and local business center, it is the headquarters of an army division which has a large maneuver field on a flattish section of the diluvial fan.

4c. Insular and Peninsular Northwestern Kyushu (Hizen Peninsula and Amakusa Islands)

Fragmentation has been so complete in this transition region of sedimentary and volcanic rocks, and culture patterns so unusually complex and variable, as to almost defy broad and simple synthesis of its landscapes. Culturally it is the westernmost extremity of Japan's densely populated industrial zone and as such, in spite of its hilly nature, occupance features are moderately abundant. Its extremely irregular outline, with deeply indented coasts and nearly-enclosed arms of the sea, is the result of subsidence of a land surface made asymmetrically irregular by erosion, faulting and volcanic activity. Natural

harbors are very numerous and fishing becomes a major occupation of the coastal villagers.

4c[1]. *North Hizen.*—The northern portion of Hizen Peninsula is a region of weak Tertiary rocks, considerable areas of which are capped with basaltic lava flows. Being a military zone no published maps with contours are available. From having skirted the coast by small motor boat, followed by a relatively short traverse across a portion of the area, I conclude that it is a hilly country of varying relief, in general under 200 meters. Where basalt is absent typical Tertiary landscapes prevail and a relatively dense population in dispersed settlements cultivates not only the intricate maze of valleys, but carries both irrigated and unirrigated fields up the adjacent slopes as well. The artificially terraced slopes in places remind one of the Setouchi borderlands. Where flows of basalt cap the Tertiary rocks, somewhat irregular tableland surfaces with even sky lines and steep slopes, often precipitous from the crest down to the geological unconformity, are typical. Mesa-like configuration is common. On top of the tablelands, smooth in parts and uneven in others, rice as well as dry crops are conspicuous, the terraced fields often having retaining walls of basaltic boulders.

Within this Tertiary subdivision of Hizen are two coal fields, Sasebo on the west and Karatsu on the east, the latter being just west of the fault valley which separates the Tertiary hill lands from the granite horst of Seburu. Each field annually produces in the neighborhood of 2,000,000 tons or less of sub-bituminous coal, that from the Karatsu mines leaving by way of the little port of Karatsu on the north coast, with which the field has rail connections. Sasebo coal is mined not only on the mainland of Hizen Peninsula in the vicinity of Sasebo City, but also on several small islands along the coast. A portion of the output is used in the industrial plants of Sasebo and Nagasaki, some is shipped to China, and considerable quantities are consumed as bunker fuel. Sasebo City (133,000) is a fortified site and owes its size and importance to the fact that it is a naval station with dockyards and an arsenal. Localized within the towns of Imari and Arita is Japan's principal center of fine porcelain manufacture, the wares from this region being internationally famous. Abundant local supplies

of kaolin are near at hand supplying the crude little potteries with their raw materials. From the train one can often see numerous straw bundles filled with porcelain standing on the station platforms awaiting shipment.

4c[2]. *The Peninsulas.*—The southern portion of Hizen is composed of three sprawling peninsulas, Sonoki (west), Nomo (south) and Shimbara (east), joined to the northern Tertiary region by Tara volcano (983 meters), a dissected strato cone

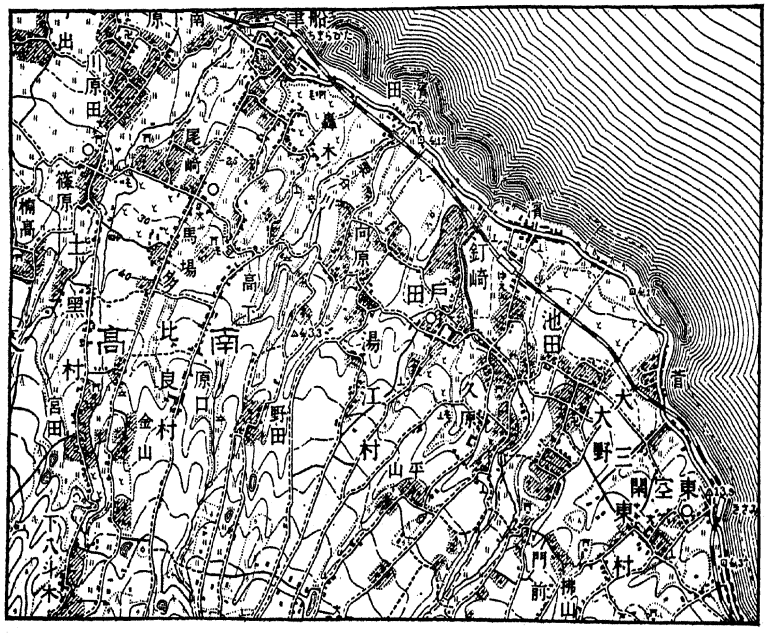


FIG. 52.—Section of the lower slopes of Unzen volcano on Shimbara Peninsula showing radical drainage pattern. Rice occupies the radial valleys and dry crops the intervening ash uplands. Scale 1:50,000.

with associated lava domes. Radial drainage pattern approaches perfection on Tara, the lower portions of the diverging valleys being devoted to paddies and the interstream ash and lava uplands to dry crops or left in woods. An almost continuous line of villages follows the volcano's shoreline, while inland, scattered rural residences are not uncommon.

Shimbara, the eastern peninsula, is chiefly composed of Unzen volcanoes,[108] the almost perfect elliptical curvature of

[108] Unzen Volcanoes: Guide-Book, Excursion E—1, 3, 4. Pan-Pacific Science Congress, Japan, 1926.

its north and east coasts being due to the conical elevation of the volcano. Physical and cultural patterns are relatively similar to those previously described for Tara, the crescentic zone of cultivation on the lower, mildly-sloping, ash apron being as much as three miles wide in places. At a moderate elevation in Unzen there has developed a relatively famous resort; cool summer climate, mountain scenery and hot springs, together with golf links and splendid hotel accommodations making it an attractive hill-station for foreigners and Japanese alike who desire to escape the tropical summer heat of the lowlands.

The sprawling Sonoki and Nomo peninsulas have ear marks of the Outer Folded Zone in that they are composed of old crystalline schists, but are joined to Hizen by volcanics and other rocks. On the whole they are hilly regions, not well developed. Occupying the head of a deep and narrow indentation about three miles from the open sea is the old port city of *Nagasaki* (205,000). Its development has never been associated with the immediate hinterland which is prevailingly hilly, almost without alluvial plains, and meagerly settled. Furthermore, its location at the sea-end of a long and rugged peninsula makes for a considerable degree of isolation which has handicapped modern development. During the long period of Japan's isolation, Nagasaki was the only foreign-trade port of the Hermit Nation and through it filtered in elements of Occidental science and culture. For years prior to the Russo-Japanese War Nagasaki was the wintering port for the Russian Asiatic fleet, so that today its landscapes bear earmarks of foreign influence.

Coinciding with the configuration of the bay-head which it occupies, the city is amphitheater-like in structure occupying a narrow coastal strip, considerable parts of it reclaimed land, and the steep slopes of the encircling hills as well. Mecking points out the strong resemblance in site and structure to many Mediterranean coastal cities and villages. Partly because of its non-typical slope site, it is one of the most picturesque of Japanese settlements. Many of the narrow and irregular streets of the residential sections on the slopes are so steep as to require steps and terraces. Business, commercial and industrial forms tend to concentrate on the more level land. Here streets are wider and more regular in pattern.

One single great manufacturing plant, the Mitsubishi Ship Building and Dock Yards, largest in Japan, with its associated machine shops, have given Nagasaki industrial fame. Next to Kobe, it is Japan's greatest boat construction center, some of the largest ships of the country's fighting and commercial fleets having been fabricated there. The mighty wharves and docks of the plant occupy 3 kilometers of waterfront along the west side of the bay. Farther north, chiefly on reclaimed land at the mouth of the Urikamigawa, is a large textile mill, a number of saw mills with their associated piles of logs, and several ice-manufacturing establishments. Nagasaki is a very important fishing port and the latter plants are associated with the packing of fresh fish.

As a port city, Nagasaki is in a period of retrogression. In 1900 it was the third ranking port of the country in foreign trade; at present it is only eighth. Significant causes for the decline are: (1) the development of competing manufactural, coal-export, and general port cities in the North Kyushu Industrial Belt; (2) the substitution of oil for coal as ship fuel thus reducing the important coaling services of Nagasaki; and (3) the loss of foreign patronage when the Russian Fleet ceased to winter there. However, its excellent harbor as well as its proximity to China and to Sasebo coal are offsetting factors which may eventually turn the tide again in favor of Nagasaki. Its fame as a passenger port is closely associated with the very fast and frequent express-boat service with Shanghai, from which it is only 24-36 hours distant. Although fewer than in former decades, many boats still call for bunker coal. Foreign imports are usually double the value of exports, with metals, especially iron, raw cotton and petroleum, holding high rank among the incoming commodities, while coal, cotton yarn, fish and refined sugar, lead in the export list. China is the single great market. Domestic trade is more than double the foreign trade in value. Ships of 5,000 to 8,000 tons can lie alongside the wharves; larger ones anchor at buoys, where depths are 9 to 19 meters, and are serviced by lighters.

4c[3]. *Amakusa Islands.*—On the Amakusa Islands to the south of Hizen, hill country, with numerous elevations of 400 to 500 meters, prevails. Only very meager alluvial patches ex-

ist, the hills coming down to the sea margins in most parts. Agricultural-fishing settlements, both dispersed and compact, dot the indented coasts while throughout the interior isolated or very loosely agglomerated farmsteads are the rule.

E. THE PACIFIC FOLDED MOUNTAINS OR THE OUTER ZONE OF SOUTHWEST JAPAN

South and east of the great morphologic fault line which separates the Inner and Outer Zones of Southwest Japan is a region of relatively high and rugged folded mountains and hill country, composed principally of crystalline schists and other old sedimentaries.[109] Well developed longitudinal valleys and ridges following the axes of the folds and extending in a general N.E.-S.W. direction; higher altitude, greater relief, and steeper slopes, general scarcity of granitic and weak Tertiary rocks, and lack of a complicated fault net—all are distinguishing characteristics setting apart this region from the Inner Zone just previously described. Normal stream erosion acting upon the original folds has reduced the region to a stage of mature dissection with great relief, and has been dominantly responsible for the secondary landform features. Flattish upland surfaces are rare, river valleys are narrow, steep-sided and are characterized by entrenced meanders. Accumulations of alluvium, either along the coasts or in the interior valleys, are of small extent. Elevations are highest along the northern boundary, close to the Median Dislocation Line, and in general the several mountain groups forming the Pacific Folded Mountains (Kyushu, Shikoku and Kii) become successively less elevated from east to west. Along the margins of the channels leading to Setouchi, which separate the Zone into three segments, the strike of the folds is at approximately right angles to the coast line, so that subsidence has resulted in a deeply indented shoreline of ria type. On the other hand the Pacific borderlands frequently have marine terraces and small elevated and dissected deltas and coastal plains. Mineral deposits, chiefly copper, of bedded replacement type, characterize a narrow zone some 500 miles long by less than 20 miles wide.

[109] Geologically and morphologically the Akaishi Mountains of Central Honshu are a part of this Folded Mountain Zone.

Climatically (at low elevations) it is the most nearly tropical region in Japan, humid midsummer months having average temperatures not much below 80°F., while January is between 40°F. and 50°F. Rainfall is very abundant, 80 to 100 inches being common on the lowlands and it is higher at elevated stations. There is an emphatic precipitation maximum in the hot season at the time of the on-shore weak monsoon. Hurricanes are also most frequent in late summer and fall. Nearly 8 months are frost free while usually on only 30 to 40 nights in winter do frosts occur. Except at high elevations, subtropical evergreen forests with dense undergrowth, originally covered the area. Palm, camphor and hazi (wax) trees, forms indigenous to warm climates, are represented.

The elevated and rugged character of the region, together with its semiisolated nature, has resulted in a much less dense settlement spacing than is true of the adjacent Inland Sea district. Arable land is relatively meager; railroad mileage is very low and is characterized by short isolated lines so that dependence upon coastwise water transport is unusually complete, although there are no really important ports. Manufacturing is relatively undeveloped.

Subdivisions of the Outer Zone

Region 1. Southern Kyushu

Although belonging to the Outer Zone of folded mountains, southern Kyushu differs from Kii Peninsula and southern Shikoku, the other two parts of the larger region, by reason that much of its southern part is a dissected ash and lava plateau with hard rock "islands" or steptoes protruding above its general level.

1a. Kyushu Folded Mountains.—Highest toward its northern margin where it terminates in a bold fault scarp overlooking the Aso ash and lava plateau, the Kyushu Mountains have aspects of a tilted block with upthrow on the north. In its western part the Kuma River flows northward against the general slope of the area, crossing it in a meandering antecedent gorge. This suggests that the river once flowed upon a peneplain surface which was later tilted and folded to form

the Kyushu Mountains. Slopes are usually steep, and the valleys narrow, although crests of the ridges are often somewhat rounded.

At the heads of the deep coastal indentations bordering Bungo Channel are small isolated triangular settlement units coincident with the restricted alluvial accumulations, separated from each other by long spurs of meagerly occupied hill land. A similar settlement pattern is repeated on the east and west coasts of Shikoku and Kii Peninsula. The meager area of level land has led to artificial terracing and cropping of the adjacent hill slopes, sometimes to elevations of several hundred feet, orange groves being conspicuous.

Piles of logs, wood and bundles of charcoal at the railroad stations testify to the importance of forest industries throughout this rugged region. Large mines are not numerous although there are at least three which employ over 500 workers. The largest is the Saganoseki mine with over 1,300 workers which, in 1930, produced copper and gold valued at 13,000,000 yen. The two above-named minerals comprise the largest part of the mineral output of the whole region. Some of the mineral deposits appear to be associated with a large granite intrusion.

1a[1]. *Hitoyoshi Tectonic Basin*,[110] within the Kyushu Mountains is nowhere duplicated in any other part of the Outer Zone. Elongated east-west, and 90 square kilometers in area, much of the basin is composed of ash and diluvial uplands, the diluvium in the form of a piedmont terrace along the southern mountain wall. The ash is relatively well dissected and much of it has been left in woods or waste, although portions have been reclaimed, principally for dry crops. The smoother diluvial surfaces are better cultivated, rice as well as dry fields being prominent. Considerable numbers of horses are pastured on the wild grasses of the ash and diluvial uplands.

1a[2]. *Sadowara (Miyazaki) Coastal Plain.*—Along a portion of the Pacific margins of the Kyushu Mountains is a wedge-shaped area of elevated coastal plain sediments, terminated on its landside by a distinct morphologic fault. The plain is composed of a basement of weak Tertiary rocks dipping in a

[110] C. Shimona: Morphology of the Hitoyoshi Basin (in Japanese). *Memorial Volume Honoring the Sixty-first Birthday of Prof. Ogawa.*

northeasterly direction, upon which rest the diluvial sediments. Emergence has been halted at intervals resulting in several distinct terrace levels with more or less abrupt wave-cut fronts. In the broader southern section, due to earlier or more pronounced uplift, a larger portion of the original diluvial surface has been removed, so that conspicuous areas of seaward-sloping flattish upland are not as prominent here as they are farther north on the costal plain. Low, rounded, Tertiary hills and dissected ash plateaus, with associated wide-open and complicated valley systems, prevail toward the south although smooth diluvial surfaces are not entirely absent. A narrow strip of poorly drained new alluvium, lagoon-like in aspect, with beach ridges along its outer margins, lies seaward from the wave-cut terrace front. This strip of alluvium widens at the mouths of rivers and follows back along the several steep-sided, but broad, parallel, stream valleys, which have been carved by a series of small rivers that descend from the mountains. The seaward strip of alluvium likewise widens toward the south and in the vicinity of Miyazaki City has the dimensions of a plain, containing many elevated remnants of beach ridges.

Until the last decade or so when the rail line along the east coast of Kyushu was completed, this Miyazaki section was relatively isolated and not so well developed. It is at present a region receiving agricultural immigrants in some numbers, these new settlers reclaiming land both on the diluvial uplands and on the wet lagoon plain. The upland farms with isolated farmsteads, in the midst of wastelands and woods, are planted almost exclusively to dry crops—soybeans, buckwheat, tea, sweet potatoes and mulberry as well as fall-sown wheat and barley. Considerable numbers of horses are pastured on the wild grasses of the uplands, this being a specialized horse-breeding region. The beach ridges are sites for dry crops while the wet lagoon lowlands, where reclaimed, are exclusively in rice. The larger area of alluvium back of Miyazaki City, because of its numerous elevated sandy spots, relics of beach ridges, has a mixture of dry crops and irrigated rice. The Tertiary and ash hills to the rear are usually left in woods or wild grass, with rice, often watered from ponds, occupying the intricate valley systems.

1b. Southern Ash Upland and Associated Steptoes.—In a depressed area lying south and west of a crescentic fault scarp which marks the southern boundary of the Kyushu Range, is a much-fragmented region, complicated both geologically and morphologically. Essentially it consists of, (1) several active or recently-dormant volcanic cones, (2) areas of dissected andesite flow irregular in outline, (3) an extensive lapillae plateau in youthful stage of dissection, and (4) several steptoes, both sedimentary and granitic, which protrude well above the ash plateau level. At the extreme south, Kagoshima Bay, enclosed between Satsuma and Osumi peninsulas, is a tectonic depression in the plateau surface.

Marking the highest elevations are the symmetrical volcanic cones, sometimes isolated, sometimes in groups. A number of them have slopes of such fresh lava or ash that they do not as yet support a forest cover and so appear stark and barren. On others, forests are abundant, or where cleared, the resulting moor-like areas provide poor pastures for horses. The andesite flows, confined to the northwestern part, have been so dissected as to produce a rugged hill and mountain country which contains little settlement. A conspicuous feature of the andesite hills is the numerous loose boulders, some of great size, which cover both flanks and crests. There is a tendency in the andesite country for the hills to have tableland crests, which, while far from level, are conspicuously less steep than the slopes of the intervening valleys. South of the main lava mass are smaller flows, less formidable in aspect, which are intricately intermingled with the ash upland.

The steptoes, numbering in the neighborhood of half a dozen, are simply higher remnants of the fractured sedimentary and igneous surface, not yet submerged beneath showers of ash or the lava flows. They vary somewhat in appearance but in general are rugged hill country, usually under 1,000 meters in elevation, with few settlements.

Acting as a matrix binding together steptoes, volcanic cones and andesite hills, the Southern Ash Plateau is scarcely continuous over extensive areas. Considerable portions of the original depositional surface still persist as flattish or rolling uplands, 150 to 350 meters above sea level. Over perhaps a larger

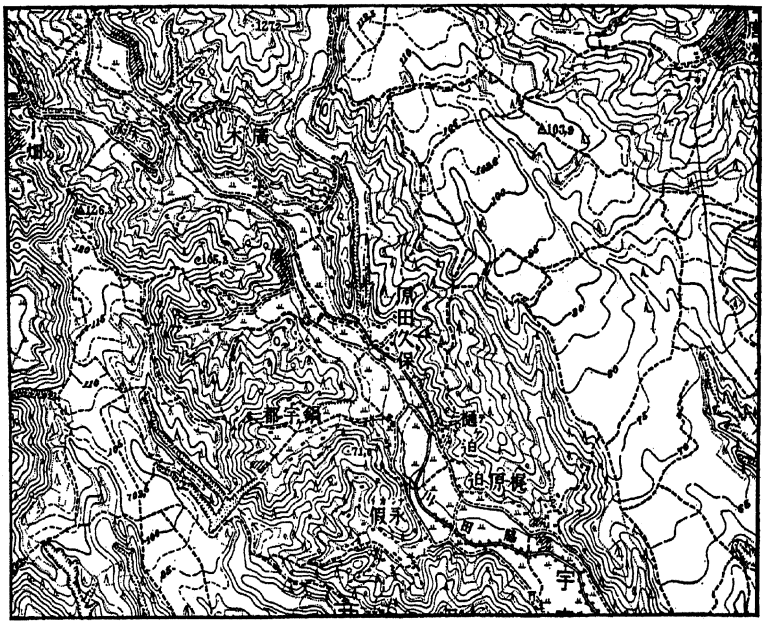


FIG. 53.—A section of the ash plateau of southern Kyushu. Distinct upland surfaces and steep sided valleys are conspicuous. The dispersed and semi-dispersed settlements are largely in the valleys. The uplands are almost exclusively in dry crops, rice being confined to the valleys. Scale 1:50,000. See plate 49.

proportion of its area however, stream erosion has reduced the region to a condition of slopes with a confused drainage pattern. It may be that part of the surface irregularity is due to the original uneven hard-rock surface upon which the ash was deposited, but certainly subaerial erosion of the unconsolidated sediments, when the whole region was probably at a somewhat lower elevation than at present, is an auxiliary cause. A further conspicuous feature of the region are the wide, flat-bottomed, steep-walled valleys, their sides showing excellent cross-sections of gray ash. Where the valley sides are not sheer, they are often mantled in dense sub-tropical evergreen forest, appearing almost tropical in aspect. Along the coasts where the ash plateau approaches close to the sea are what appear to be old ash covered fans or cones with incised stream valleys. The immediate sea margins are flanked with beach ridges, back of which are partially-filled lagoons.

Somewhat isolated from northern Kyushu and the rest of Japan by the formidable barrier of the Kyushu Range, this southernmost region is relatively provincial in outlook. Culture

connections are with the Ryukyu Islands to the south. Settlement types are varied, for while villages are by no means absent, semi and completely-dispersed rural residences appear to prevail. There is a tendency for settlements to avoid the flat-topped ash uplands which are exposed to the full force of the typhoons that sweep the area in late summer and early fall, and where, at least in places, water is difficult to obtain. More commonly rural inhabitants seek the shelter of the valleys, locating their residences close to the bases of valley walls, where there is the dual advantage of, (1) slight elevation, offering protection against floods, and (2) the presence of spring water. In July 1932, when working in this section, large areas of rice were so deeply inundated as to be completely ruined. Settlements located at the base of cliffs are in some danger from landslides at times of heavy rains or earthquakes.

Rural dwellings are often only crude thatched huts, distinctly tropical in aspect, with steep roofs and overhanging eaves, set in the mist of dense sub-tropical vegetation where banana and bamboo trees are conspicuous. Tile roofs appear to be absent except in the compact larger villages and cities. Rural settlements are commonly amorphous in structure, for while the residences may be areally grouped, the individual units are often separated from each other by fields or woods with only trails connecting them.[111]

Rice is relatively less important in this region of ash uplands than where alluvial areas are more extensive, occupying only 34 to 35 per cent of the cultivated area. It is confined largely to the valley bottoms and coastal lowlands. On the flattish ash uplands dry fields of tobacco, sugar cane, beans, sweet potatoes, taro, vegetables, upland rice, fruit trees and winter grains are usual. This is the only part of Japan Proper where sugar cane is a conspicuous crop. Both tobacco and sweet potatoes are very prominent. Since the upland surfaces are not level, crude terracing is resorted to in laying out the fields. Horse breeding is of some importance in this area and portions of the ash uplands are used as pasture lands.

Large cities are not conspicuous in southern Kyushu for those important commercial and industrial services which cities

[111] Hall: Some Rural Settlement Forms in Japan, *op. cit.*, p. 104-110.

perform are not well developed. This is a major contrast between South Kyushu and that part of the island north of the Folded Range. Kagoshima (137,000), the metropolis of the region, is located on a narrow coastal plain at the base of the ash plateau, fronting upon the quiet waters of Kagoshima Bay and almost under the shadow of imposing Sakurajima Volcano. Like scores of other cities and villages in southern Kyushu it is an old castle town. Since Kagoshima is the only port of South Kyushu, it has a relatively extensive and populous hinterland. Its shallow inner harbor can accommodate ships of up to 2,000 tons; larger ones anchor outside the breakwater. In foreign trade it is almost exclusively an import center, receiving rice from southern Asia, and soybeans, bean-cake, fish, and bones from China and Manchuria. Domestic trade far exceeds foreign, its principal connections being with the Ryukyu Islands and the industrial ports of the Inland Sea.

1b[1]. *Miyakonojo Basin.*—Along the eastern margin of the ash area where it contacts a fragment of the Folded Mountains, is the Miyakonojo Basin, containing the most important rural population cluster of the entire region. It is probably a tectonic depression, partially filled with ash, which has been carved into a series of low terraces by stream erosion. Rice fields occupy extensive areas on the smooth terrace surfaces as well as on the floodplains.

Region 2. Southern Shikoku

Lacking a volcanic appendage like Kyushu's, southern Shikoku is exclusively a region of folded mountains, with a notable linearity of ridges and valleys.[112] It too has the profile of a dissected tilted and folded block, with a gentle slope toward the south. Deeply indented ria forms, indicative of subsidence, characterize both the east and west coasts, while the tips of the two southern peninsulas have marked marine abrasion platforms which terminate on their sea sides in wave cut cliffs. Tosa Bay between the peninsulas is a sunken block.

Settlement in such a rugged region is naturally meager. This is especially true in the higher northern parts, although

[112] Shingo Yehara: Geologic and Tectonic Study of Shikoku, *Japanese Journal of Geology and Geography; Transactions*, VII, No. 1, pp. 1-42.

in that section occasional mining settlements, in addition to those deriving their sustenance exclusively from agricultural and forestry pursuits, are to be found. In general the valleys have such narrow floors that there is little level land for rice cultivation, but along certain stretches of their courses they occasionally open up into broader basin-like areas which become marked nodes of occupance. In a few instances rivers have reduced portions of their basins to complicated hill lands where dispersed agricultural farmsteads are relatively numerous and artificial terracing is conspicuous. Along the deeply indented ria coasts, small isolated deltas at the heads of long narrow bays provide the principal settlement areas. Farther south the marine abrasion platforms provide restricted areas of smooth surfaces for cultivation. With such a limited amount of agricultural land available, relatively more importance attaches to the forest and fishing industries. Not only are the usual forest industries, such as the preparation of lumber, charcoal, and firewood, relatively well developed, but also the manufacture of native paper from the fibres of two indigenous shrubs (*Edgeworthia papyrifera* and *Broussonetia Kashinoki*) which occupy thousands of acres on the mountain slopes of southern Shikoku. Although this is the nation's most specialized region for Japanese paper manufacture, the industry is not very conspicuous since it is housed in small plants.

The single largest compact population cluster is coincident with the small 2a. KOCHI PLAIN at the head of Tosa Bay. In this vicinity a series of east-west fractures have produced a marked ridge-and-valley type of surface configuration, the long axes of the forms being parallel with the coast. Subsequent sinking has resulted in a very irregular shore line but this has been considerably smoothed by river and wave aggradation, which has at the same time filled the longitudinal valleys back from the coast. The dense population of the much-fragmented alluvial plain occupies both small agglomerations and isolated individual farmsteads, while the dissected hill lands bordering Kochi likewise have an important dispersed population. This plain has distinction in Japan in that it is only part of the country where two crops of rice are obtained during the course of a year. Isolation handicaps all of southern Shikoku, there be-

ing no rail connection with the Inland Sea shore, so that small coasting boats, and difficult bus service over the mountains, are the only means of connection with neighboring areas. A few short and isolated fragments of railroad are all that at present exist.

It is the narrow belt of crystalline schists along the northern higher margin of Shikoku's Folded Mountains which contain the island's mineral wealth, principally copper of bedded replacement origin. At least 12 mines in the region employ over 100 men each, one of these, Besshi, being counted among the country's greatest, employing 3,600 workers and in 1930 having a total output valued at 11,639,000 yen, of which over 8,000,000 yen represented copper. Besshi is located in the rugged mountains 2,500 feet above sea level, 12 miles south of the little port of Niihama on the Inland Sea coast, with which it is connceted by rail.[113] On the island of Shisaka, 9 to 10 miles due north of Niihama, is the smelter for this mining area, the isolated island location having been selected in order to obviate any injury to crops from the smelter's fumes. Niihama contains a copper refinery. The principal Besshi ore body, containing about 3 per cent of metallic copper, outcrops near the summit of a rugged mountain ridge and is entered by an inclined shaft at an angle of 49°.

Region 3. Kii Peninsula

In its isolation, rugged mountainous relief, lack of significant aggradational plains, meager population, and relatively great emphasis upon forestry and fishing, Kii bears very close resemblance to southern Shikoku. Its interior is one of the least occupied parts of all Japan so that settlement is emphatically peripheral. In most parts the hills come down nearly to the water's edge and terminate in wave-cut cliffs. Narrow abrasion platforms are in places characteristic, and these are not infrequently cultivated by agriculturists living in isolated farmsteads. Where weak Tertiary rocks occur along the coast, slopes are less steep, dissection is greater, and occupance more com-

[113] The Besshi Copper Mine and Yashima. Guide Book Excursion E-2, Pan-Pacific Science Congress, Japan, 1926.

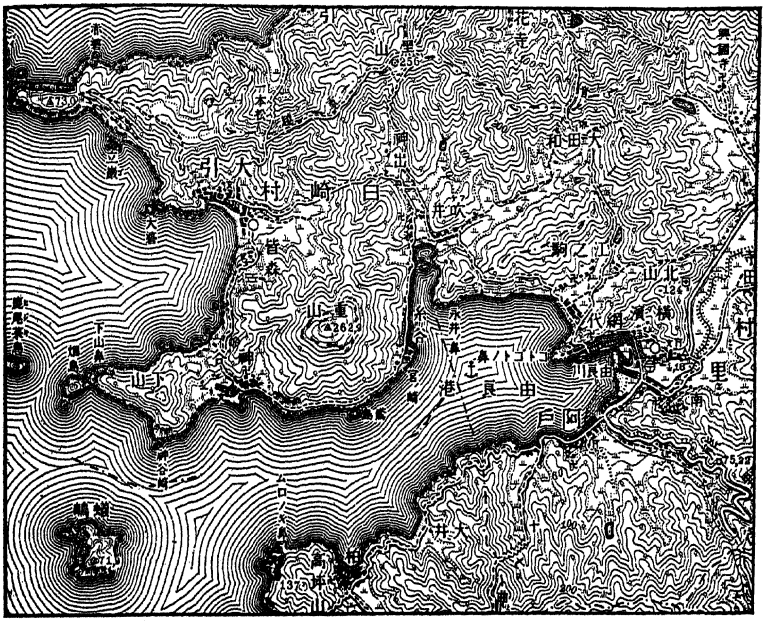


FIG. 54.—The deeply indented and rugged coast of western Kii. Similar coastal landscapes prevail along the margins of eastern Kyushu and of Shikoku where the trend of the folded ranges is at right angles to the channel entrances to the Inland Sea. Scale 1:50,000.

plete. Portions of the shore line are much indented, the small bay-head deltas providing sites for numerous little agricultural-fishing villages. Since there are only a few miles of railroad within the entire region, communication between settlements is largely by means of small coastal steamers or sailers from Osaka.

ACKNOWLEDGEMENTS

All except four of the photographs (plates 19, 21, 31, 37) are by the author. I am indebted to the American Geographical Society of New York for the loan of 7 plates (7, 9, 29, 30, 32, 34, 35) which appeared in the author's articles in the Geographical Review for April 1930 and July 1934. The Annals of the Association of American Geographers has kindly loaned 22 plates which appeared in the author's articles in that magazine for September 1928 and December 1930.

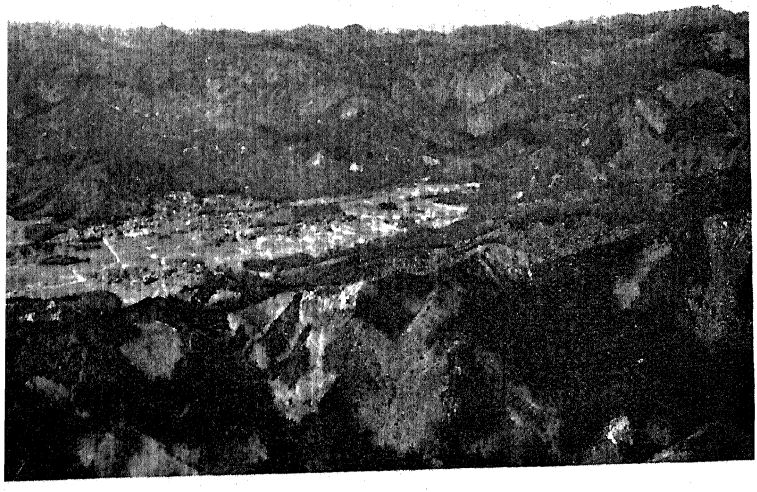


PLATE 1. A representative section of the hilly interior of Japan. Note the small interior basin with its cover of paddy fields. It is estimated that 75 per cent of Japan's area has slopes too steep for normal cultivation.

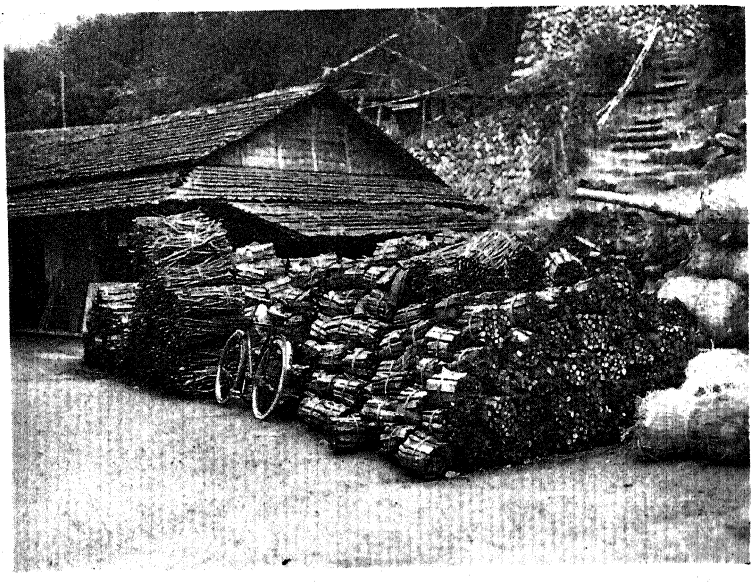


PLATE 2. A mountain dwelling surrounded by products from the forests. The straw covered bundles contain charcoal. From the sale of forest products the mountain residents receive a considerable part of their cash income.

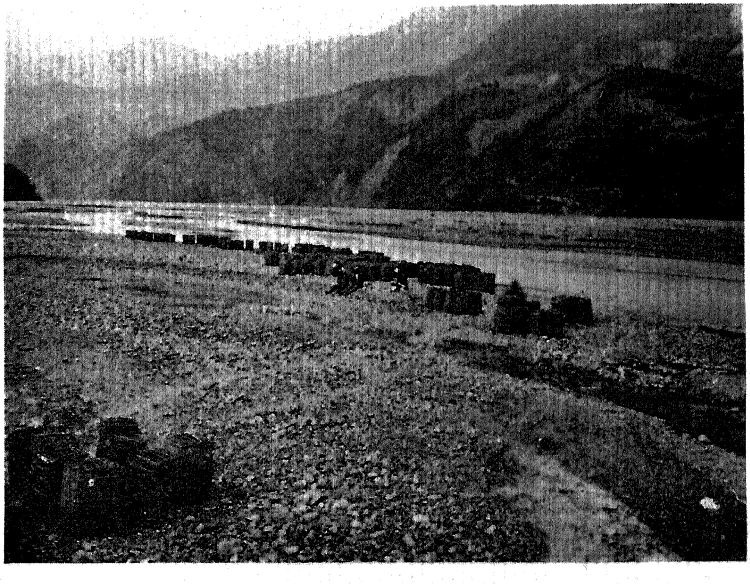


PLATE 3. Bundles of charcoal which have been floated down from the mountains to the markets on the plains.

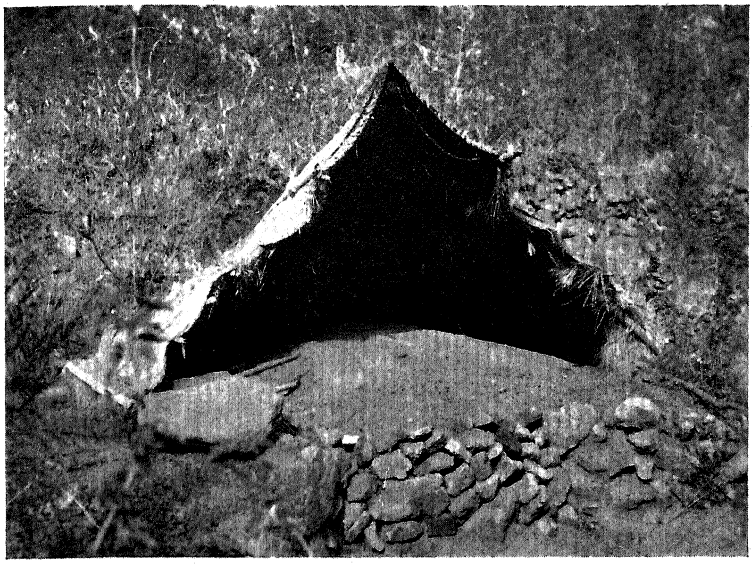


PLATE 4. A small charcoal pit, typical of an industry common to the hilly interior of Japan.

PLATE 5. The relatively smooth crown of a diluvial upland with its rectangular pattern of tea and vegetable gardens. Note that the tea hedges frequently enclose vegetable and grain plots. Shizuoka.

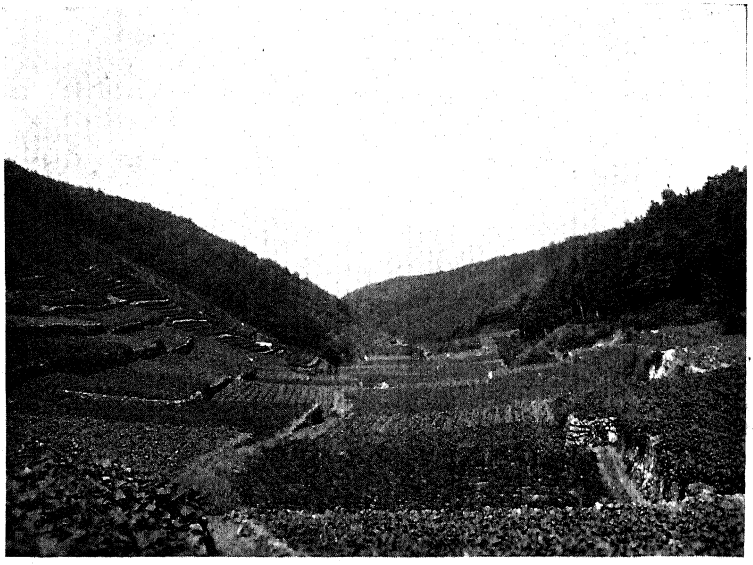


PLATE 6. Artificially terraced vegetable plots along the flanks of a diluvial upland. Smooth boulders from the diluvium form the retaining walls of the fields. Shizuoka.

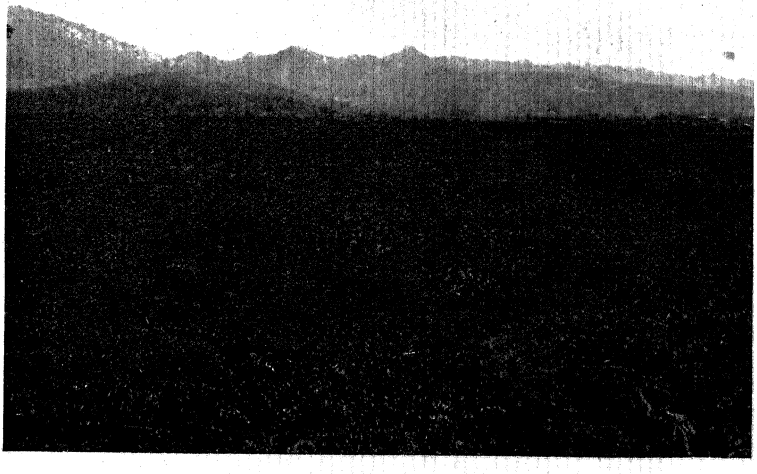


PLATE 7. Considerable areas of flattish diluvial upland are unplanted and left idle or meagerly pastured. Scene in Iwaki Basin of north-

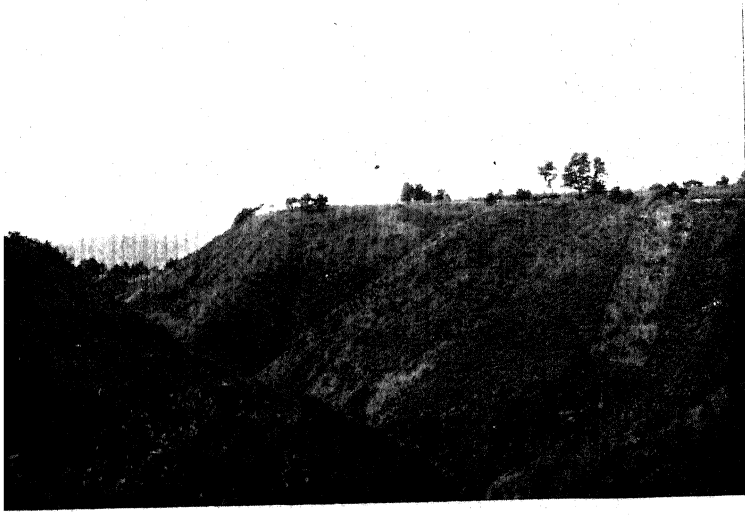


PLATE 8. The even sky line of a diluvial terrace in Shizuoka Prefecture. Tea gardens almost monopolize its crest. The deeply incised streams make the upland surface less useful for irrigated crops.

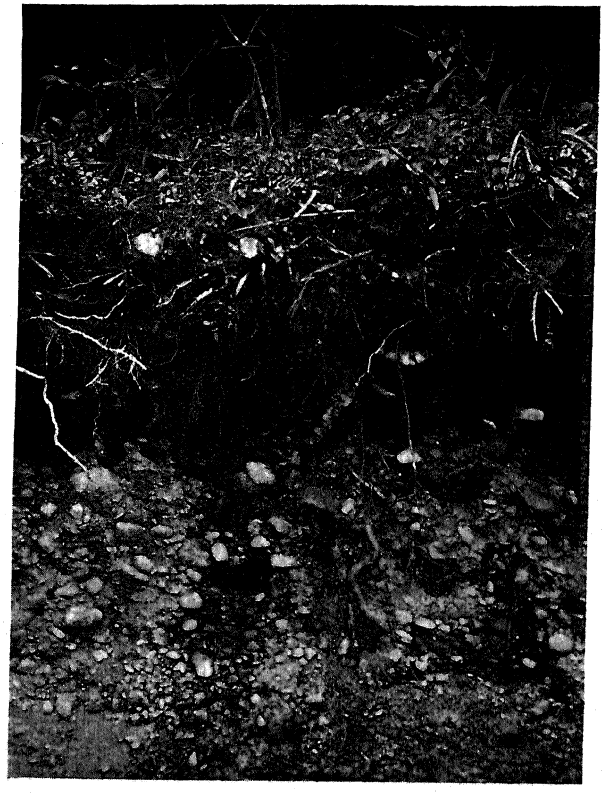


PLATE 9. A soil profile of a diluvial upland in Shizuoka Prefecture. The subsoils are poorly assorted sands and gravels.

PLATE 10. Large uninterrupted areas of tea gardens are characteristic of this flattish diluvial upland surface. Note the indistinct and irregular profile of the higher mountains in the background. Shizuoka view.

PLATE 11. A representative delta-plain covered with small diked paddy fields. Scene in late spring shortly after young rice seedlings have ben transplanted.

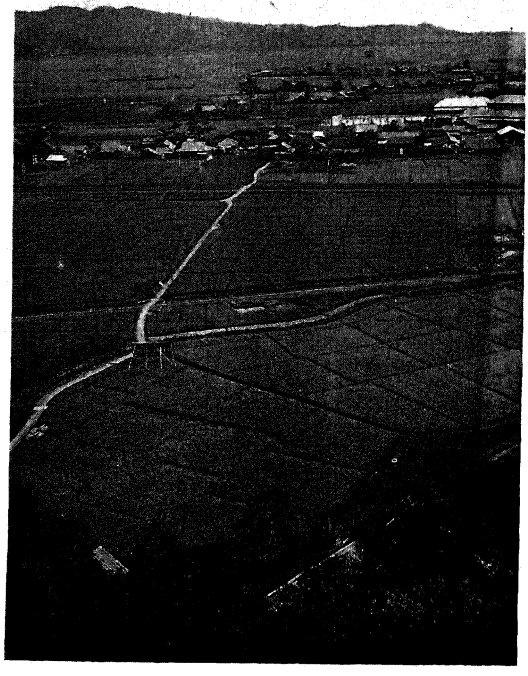


PLATE 12. A representative delta-plain in late summer when rice is mature.

PLATE 13. A delta-plain with fallow rice fields in winter.

PLATE 14. A delta-plain on which the paddy fields have been replanted in fall-sown crops. Note that water stands in some of the troughs between the ridges. View taken in spring. Shizuoka.

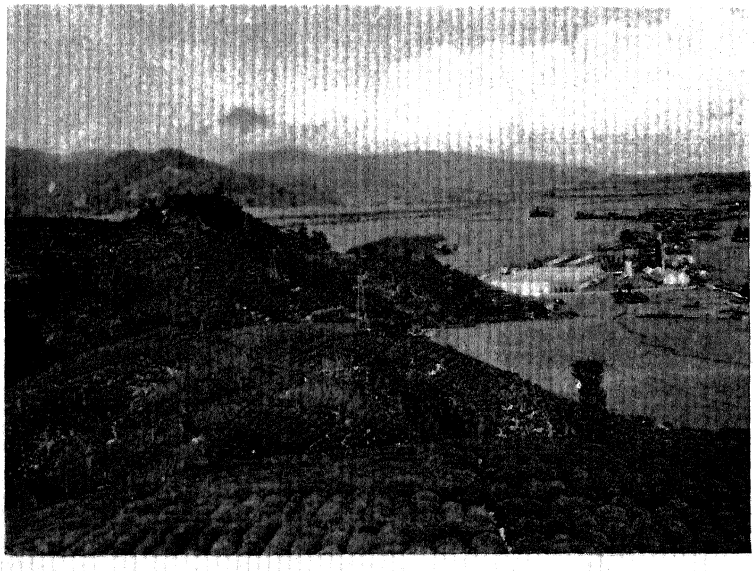


PLATE 15. Note the abrupt change in culture where the hard rock hill slopes covered in dry crops, chiefly tea, make contact with the flat alluvial plain specialized in irrigated rice. Shizuoka.

PLATE 16. Wide riverine belts, planted in dry crops, are typical of many Japanese delta-plains. The irregular surfaces and coarser soils of these belts cause them to be not well suited to irrigated rice.

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PLATE 17. On many of the delta-plains of Japan the river channels are higher than the plain proper. In this photograph the river is so elevated that the road passes under rather than over the stream.

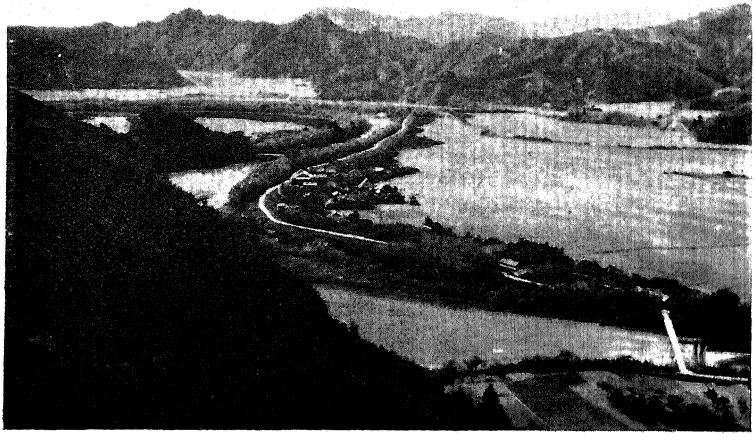

PLATE 18. A diked stream on a small alluvial plain (Shizuoka). In the foreground the river is swinging close to the hills so that only one dike is visible. Note that a road follows the crest of the dike with a shoestring village also occupying this elevated site.

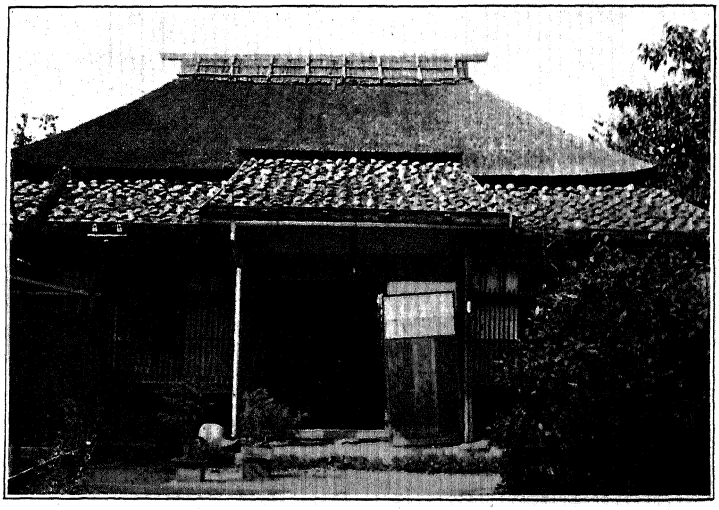

PLATE 19. A representative rural house in northwestern Japan. Note the heavy thatched roof. (Photograph by Herman R. Friis.)

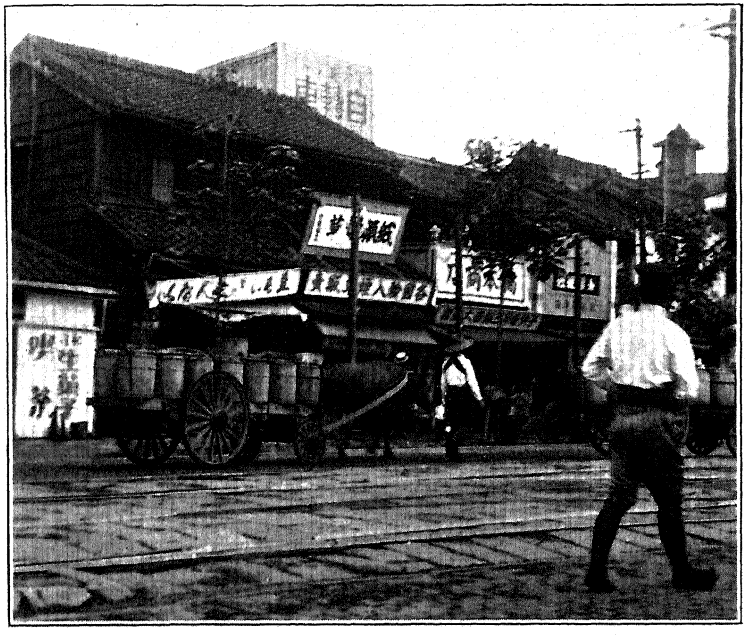

PLATE 20. A street of small open-front shops and residences. Although the photograph was taken in Tokyo, except for the wider street it is representative of scores of Japanese cities. The ox-drawn wagons are loaded with kegs of nightsoil.

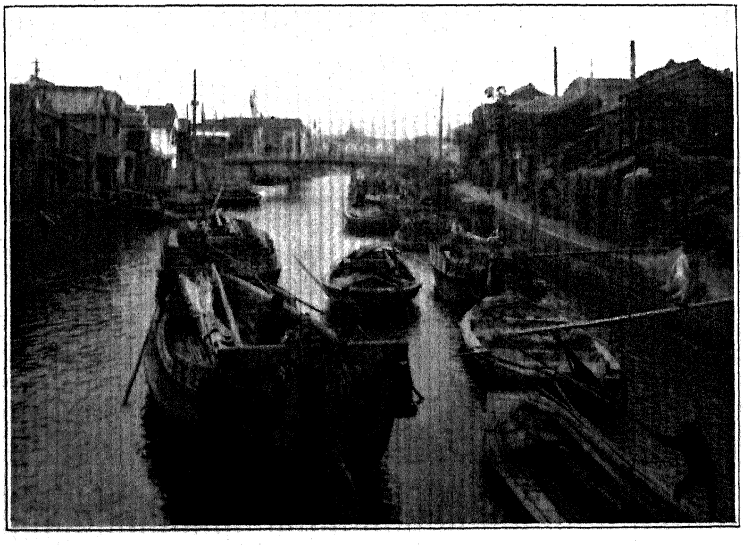

PLATE 21. Numerous canals intersect Japanese cities, most of which occupy low alluvial sites. Warehouses and manufactural plants tend to collect along the canals because of cheap transportation facilities. (Commercial photograph)

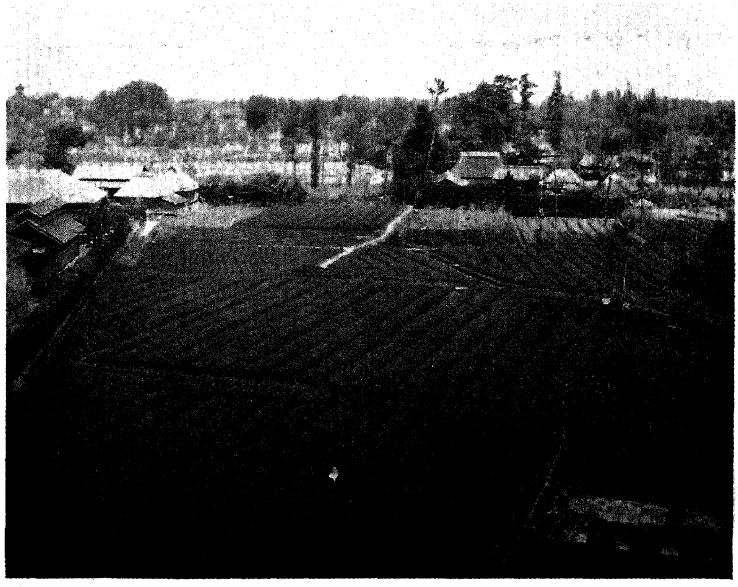

PLATE 22. Isolated rural dwellings or small clusters of dwellings characterize settlements on some of the steeper alluvial fans. A section of the Oi Delta-fan in Shizuoka Prefecture with dispersed settlements. The plain appears to be cluttered, and extensive vistas are not common. Winter grains occupy the rice fields in the foreground.

REGIONAL LANDSCAPES

1. HOKKAIDO

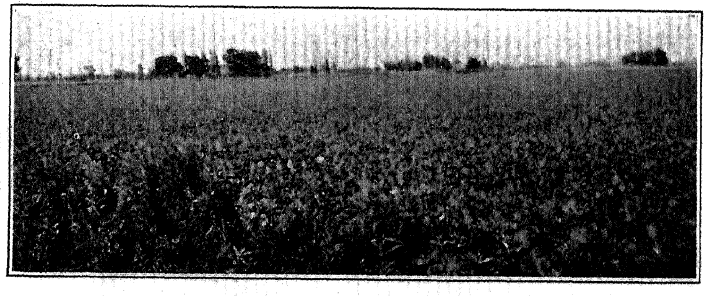

PLATE 23. Relatively large fields of unirrigated crops, and isolated farmsteads with windbreaks on the Ishikari Plain, Hokkaido.

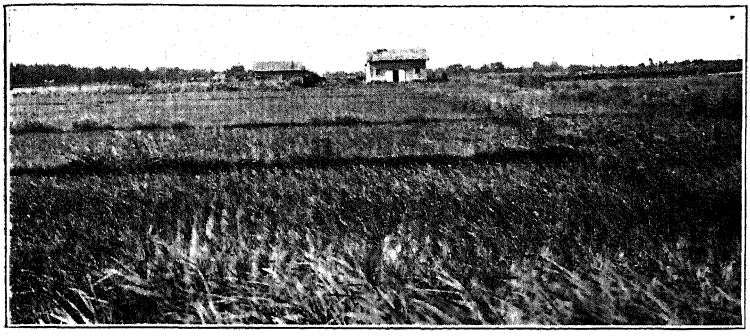

PLATE 24. Relatively large rectangular rice fields on the Ishikari Plain, Hokkaido. In the farmstead the barn is conspicious.

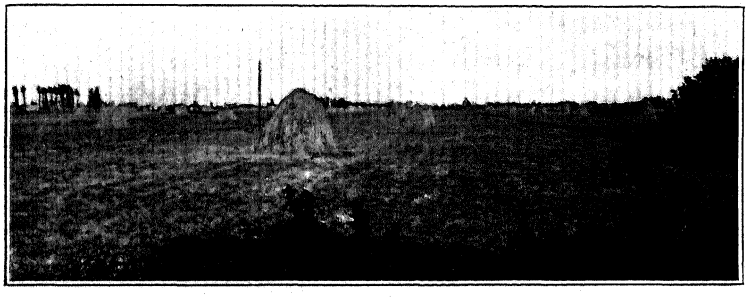

PLATE 25. Stacked hay on the Ishikari Plain. Note the relatively large size of the field.

PLATE 26. The farmstead of a dairy farm located near Sapporo on the Ishikari Plain. The hip-roof haybarn, silo, and substantial little house look quite occidental. Maize occupies the fields in the foreground.

PLATE 27. A frontier farm with stumps still remaining in the fields. Typical of northern and eastern Hokkaido.

2. Ou

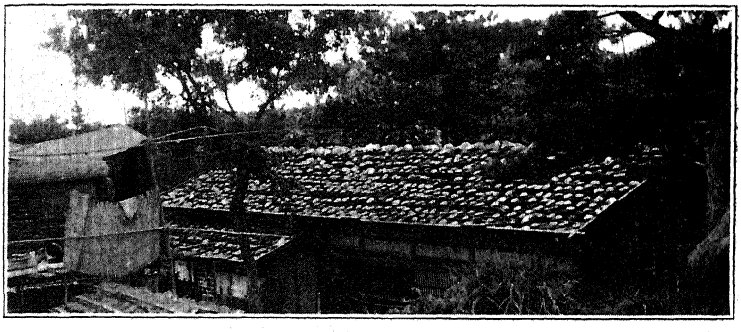

PLATE 28. House on Echigo Plain with shingle roof weighted down with boulders. This is typical of windy northwestern Japan.

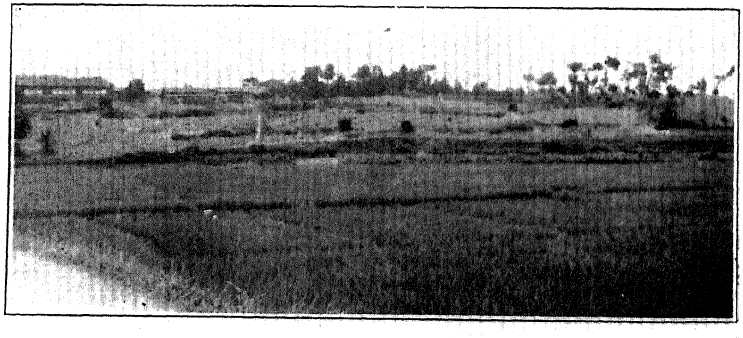

PLATE 29. A series of parallel beach ridges with intervening wet trough-like lowlands are characteristic of the seaward margins of the Japan Sea plains of Ou. This photograph, taken on the Echigo Plain, shows one of the wet longitudinal lowlands planted to rice in the foreground, with a sandy beach ridge beyond devoted to dry crops.

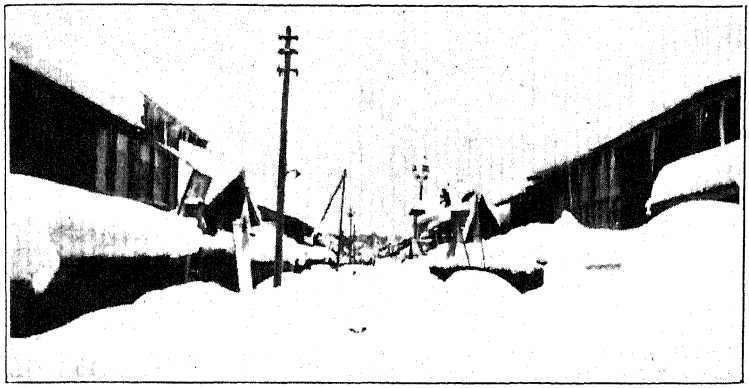

PLATE 30. A winter scene in Hirosaki, northwestern Honshu. Heavy snows are characteristic of the Japan Sea coast (Photographer unknown).

PLATE 31. On the wet lowlands of northwestern Japan rice and rice straw are hung on bare poles or spindly trees along the margins of the fields to dry.

PLATE 32. Covered sidewalks or "gangi" are typical of the villages along the snowy Japan Sea coast of northern Honshu.

3. CHUBU

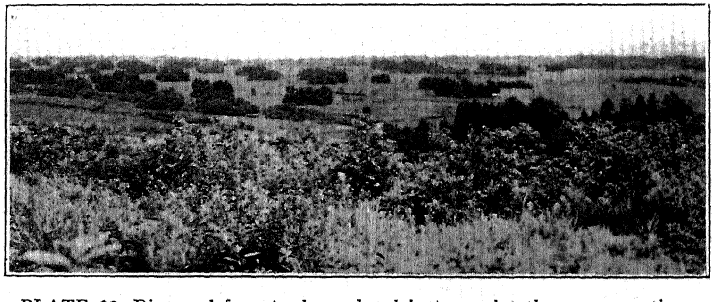

PLATE 33. Dispersed farmsteads, enclosed in trees, dot the upper portions of the Toyama Piedmont. View taken from a higher diluvial terrace level.

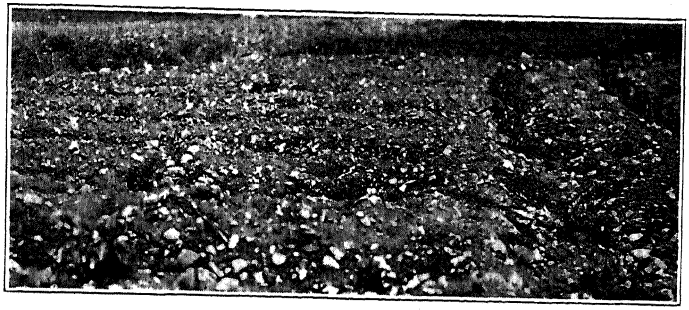

PLATE 34. Coarse stony soils characterize the upper parts of alluvial and diluvial fans which occupy the fault basins of Fossa Magna. Such sites are better suited to a crop such as mulberry than to irrigated rice. Suwa Basin.

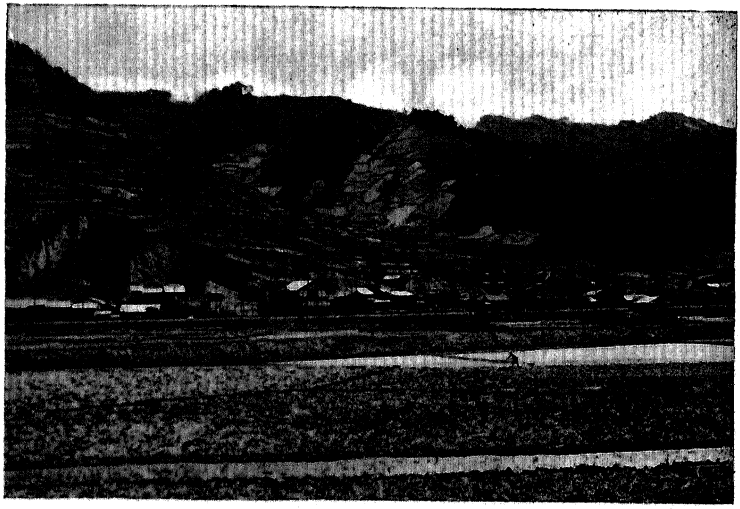

PLATE 35. Not only on the steep alluvial-diluvial fans, but also on the slopes of the hard-rock hills is mulberry a specialized crop. Suwa Basin.

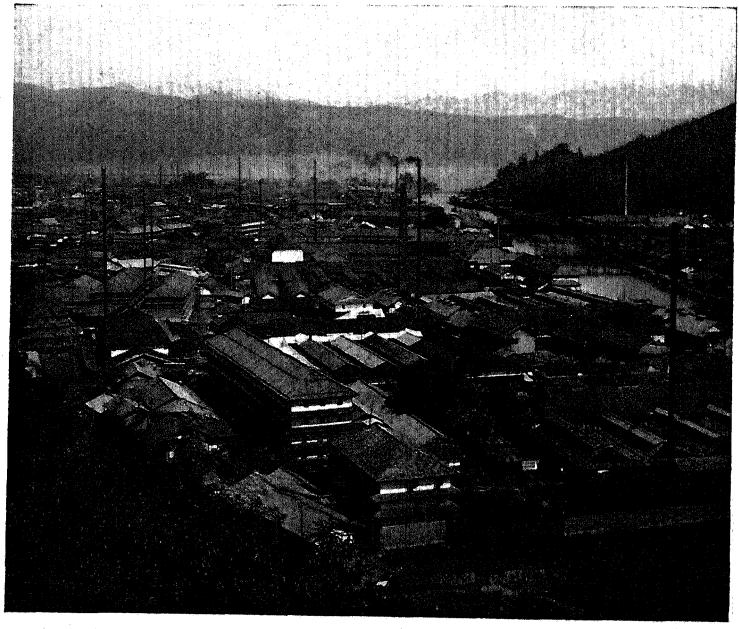

PLATE 36. Okaya, in the heart of Japan's mulberry and cocoon-producing district (Suwa Basin), and the greatest center of silk reeling in the Empire. The filatures and cocoon warehouses are typical of silk reeling cities.

PLATE 37. Two-story occupance on the Kwanto Plain. Small irregular rice fields characterize the low alluvium, while larger and more rectangular plots of dry crops and planted woodlands occupy the higher diluvial upland. A sinuous belt of woodland marks the escarpment between the two levels. (From a folio of airplane photographs published by Tetto-Shoin Publishing Co; Tokyo).

PLATE 38. An elevated plot of mulberry surrounded by wet rice fields. Taken on the Tenryu Plain in Shizuoka but typical of the Nobi (Nagoya) Plain and others as well.

4. Inner Zone of Southwest Japan

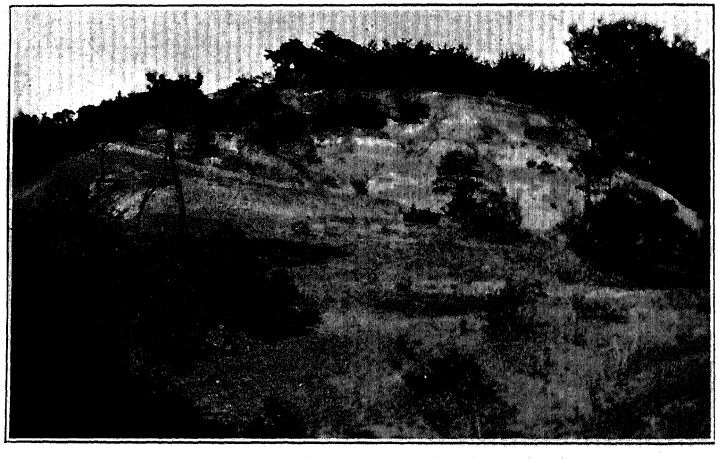

PLATE 39. One of the dissected and relatively barren high diluvial terraces in the Kinki region.

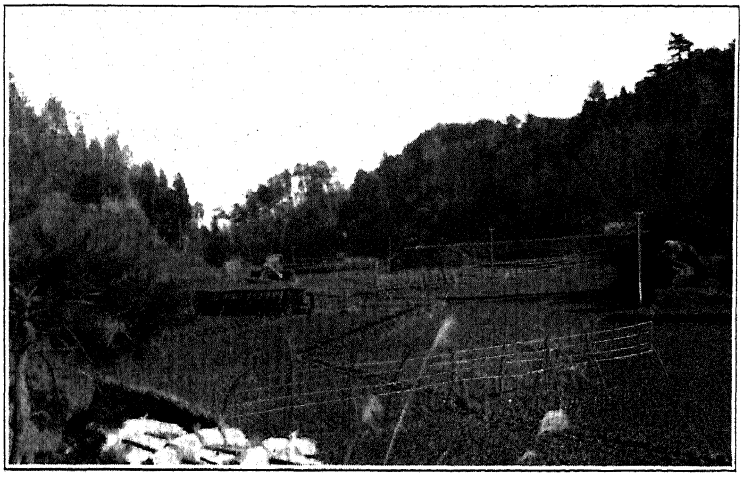

PLATE 40. The valleys of the high and dissected diluvial terraces are often in rice fields.

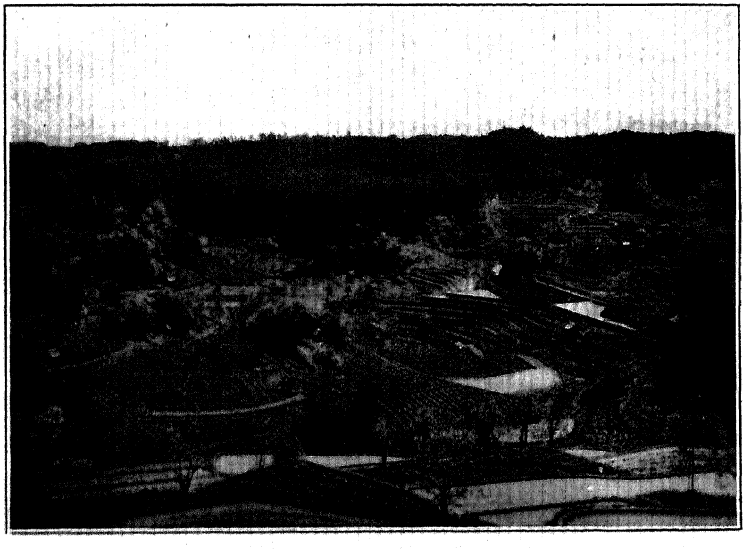

PLATE 41. Terraced rice fields watered by ponds, in one of the high diluvial terraces of Biwa Basin.

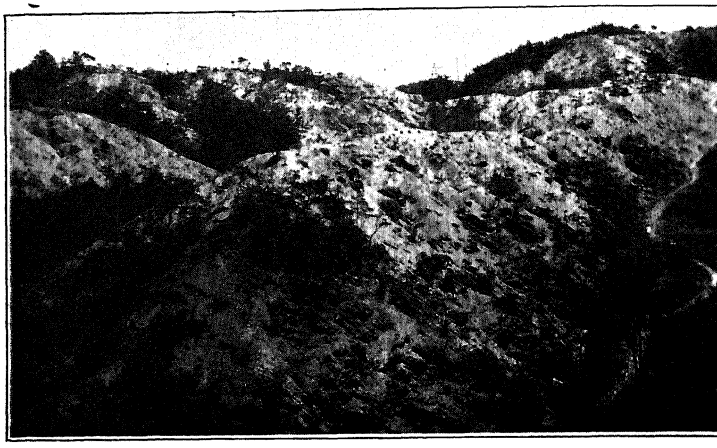

PLATE 42. Bare whitish granite slopes, usually round in contour, with a meager vegetation cover, are characteristic of the Inland Sea Borderlands.

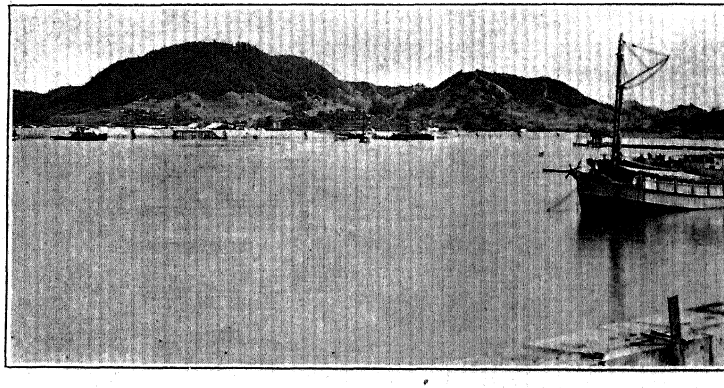

PLATE 43. Typical scene in Inland Sea Basin. Rounded granite hills, the whitish rock often showing through the sparse vegetation cover, have their lower slopes well cultivated. Numerous craft of various sorts serve the multitudes of little setttlements.

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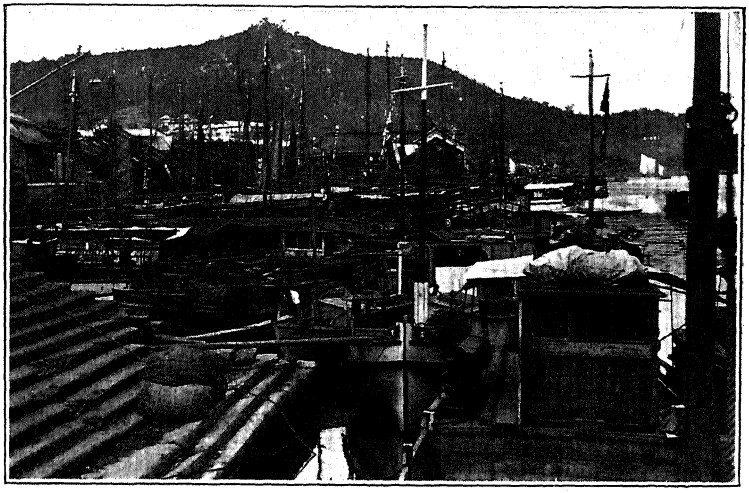

PLATE 44. Tiny freighters and fishing boats (steam as well as sailers) crowd the harbors of the Inland Sea ports. Scene at Onomichi.

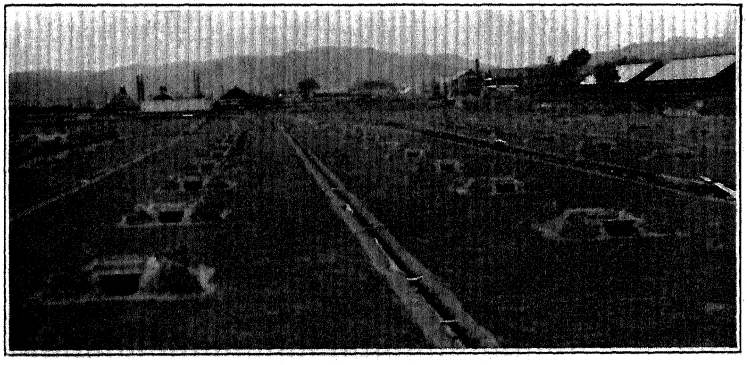

PLATE 45. Salt fields along the Inland Sea coast near Onomichi. Note the boiling stations in the distance along the margins of the fields.

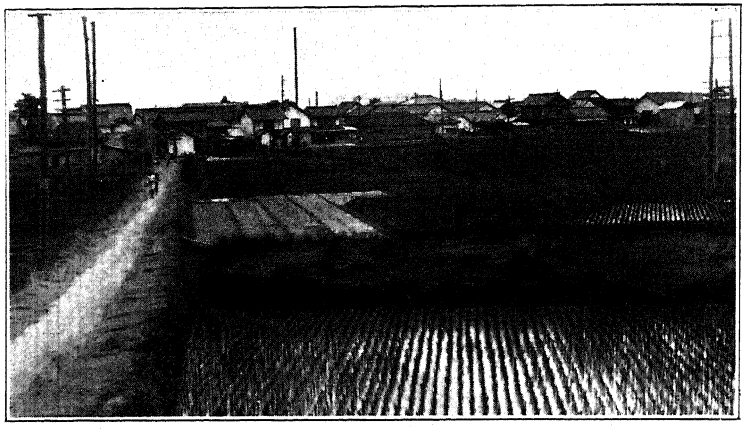

PLATE 46. Fields of "I", the reed from which the "tatami" or floor mats are made, along the Inland Sea coast near Onomichi. Long rows of the drying reed line the road.

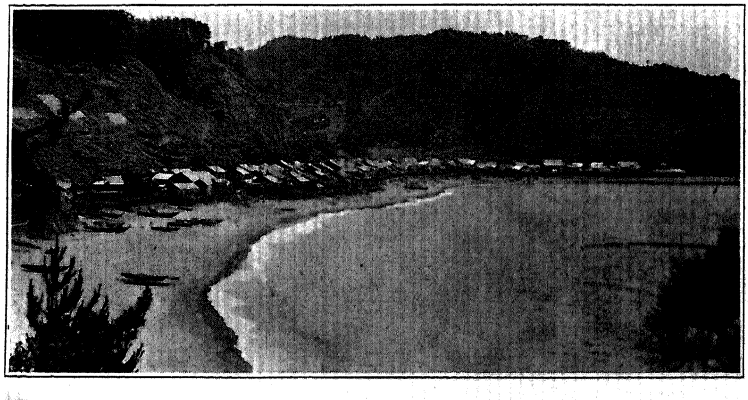

PLATE 47. A small "strassendorf" village along the abrupt Sanin coast of northern Chugoku, west of Shinji Horst. This, like many other villages of Sanin, is located at the mouth of a valley, which provides natural access to the interior.

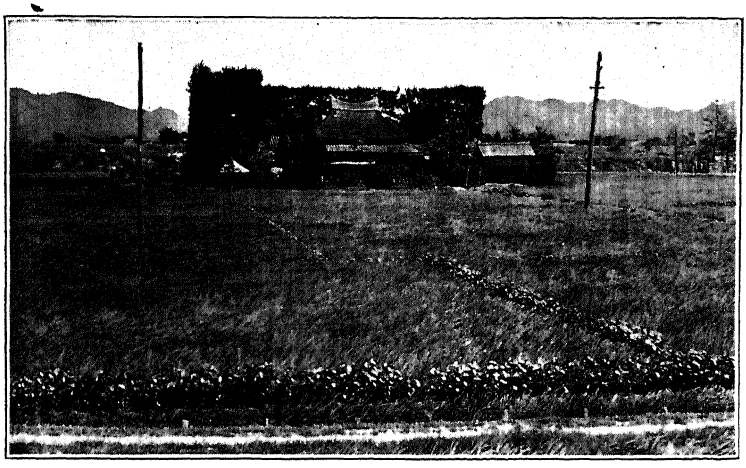

PLATE 48. An isolated rural residence, protected by a high tree-hedge on the north and west, typical of the Kizuki Delta-plain back of Shinji Horst (Sanin).

5. Outer Zone of Southwest Japan

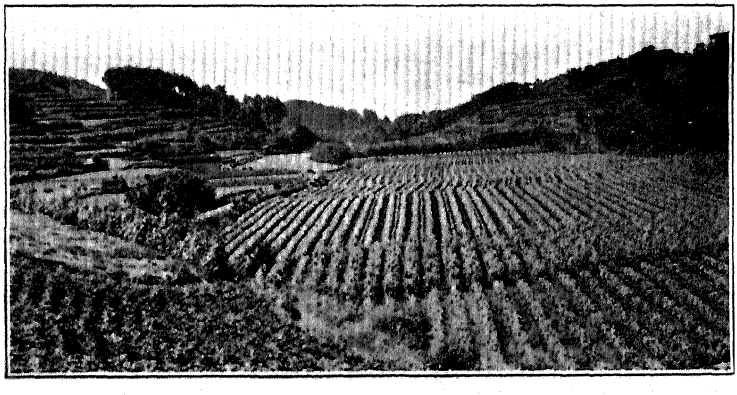

PLATE 49. Unirrigated fields occupy the somewhat uneven upland surface of the ash plateau of South Kyushu.